1962-63 FORD

Galaxie, Galaxie 500 and

STATION WAGONS

SHOP MANUAL

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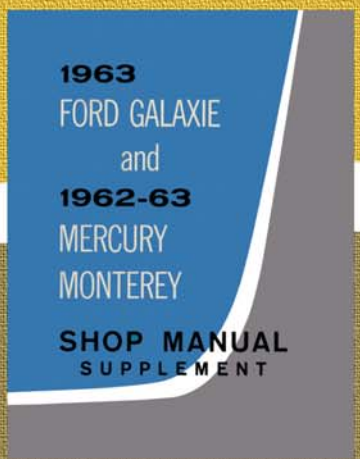

Includes:
1963 Ford Galaxie, 1962-63 Mercury Monterey Shop Manual Supplement

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1962

FORD GALAXIE

SHOP MANUAL

SERVICE DEPARTMENT
FORD DIVISION
Ford MOTOR COMPANY
SECOND PRINTING - NOVEMBER 1962

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FOREWORD

This manual provides information for the proper servicing of 1962 Ford Galaxie, Galaxie 500, and Station Wagons. The descriptions and specifications contained in this manual were in effect at the time the manual was approved for printing. The Ford Division of Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design, without notice and without incurring obligation.

SERVICE DEPARTMENT
FORD DIVISION
FORD MOTOR COMPANY

FORD GALAXIE IDENTIFICATION

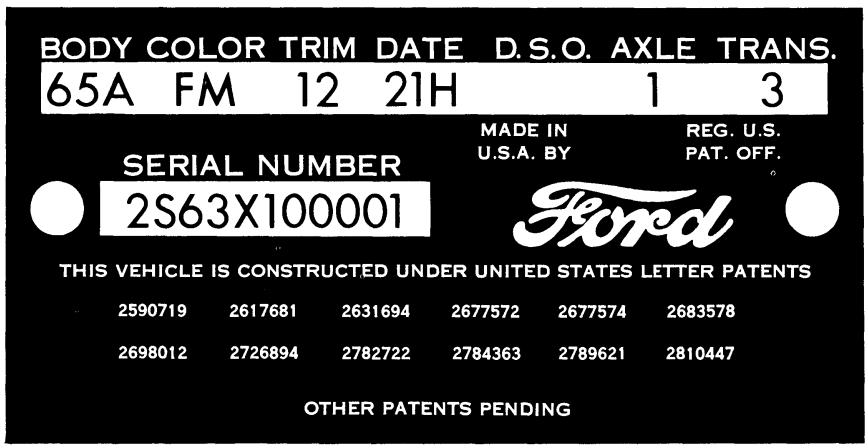
BODY COLOR TRIM DATE D.S.O. AXLE TRANS.
65A FM 12 21H 1 3
MADE IN U.S.A. BY
REG. U.S. PAT. OFF.
SERIAL NUMBER
2S63X100001
Ford
THIS VEHICLE IS CONSTRUCTED UNDER UNITED STATES LETTER PATENTS
2590719 2617681 2631694 2677572 2677574 2683578
2698012 2726894 2782722 2784363 2789621 2810447
OTHER PATENTS PENDING
M1071-A

Fig. 1—Ford Galaxie Patent Plate

The Patent Plate is attached to the left door front pillar.

VEHICLE DATA

Example (Fig. 1):

65A FM 12 21H 1 3

65A.....2 Door Club Victoria
FM.....Light Blue and White
12.....Blue Venice Fabric and Vinyl
21H.....21st day August
1.....3.00:1 Ratio Axle
3.....Fordomatic

BODY

Galaxie

54B.....4 Door Sedan
62B.....2 Door Sedan

Galaxie 500

54A.....4 Door Sedan
62A.....2 Door Sedan
65A.....2 Door Club Victoria
75A.....4 Door Town Victoria
76A.....2 Door Convertible

Station Wagons

71A.....4 Door 9-Passenger Country Squire
71B.....4 Door 6-Passenger Country Sedan
71C.....4 Door 9-Passenger Country Sedan
71D.....4 Door 6-Passenger Ranch Wagon
71E.....4 Door 6-Passenger Country Squire

COLOR

Two-tone paint codes use the same symbols as the single colors except that two symbols are used. The lower body color code will appear first in the patent plate paint color space.

If a special paint is used, the paint color space will not be stamped.

Code	M-30J Number	Color	Sales Name
A	1724	Black	Raven Black
D	1451	Medium Turquoise Metallic	Ming Green
E	1448	Medium Blue Metallic	Viking Blue
F	1449	Light Blue	Baffin Blue
H	1447	Dark Blue Metallic	Oxford Blue
J	1515	Red	Rangoon Red
M	1238	White	Corinthian White
P	1454	Medium Green Metallic	Silver Moss
Q	1371	Light Gray Metallic	Silver Gray
R	1456	Yellow	Tucson Yellow
T	1543	Honey Beige	Sandshell Beige
V	1470	Chestnut Metallic	Chestnut
Z	1427	Beige Metallic	Fieldstone Tan

TRIM

Deviation trim sets will use existing trim codes plus a suffix. A trim code with a numerical suffix is not serviced, while a trim code with an alphabetical suffix is serviced.

Code	Trim Schemes
12	Blue Venice Fabric & Vinyl
13	Green Venice Fabric & Vinyl
14	Beige Venice Fabric & Vinyl
15	Red Venice Fabric & Black Vinyl
16	Black Venice Fabric & Black Vinyl
17	Turquoise Venice Fabric & Vinyl
19	Chestnut Venice Fabric & Vinyl
21	Gray Basket Fabric & Vinyl
22	Blue Basket Fabric & Vinyl
23	Green Basket Fabric & Vinyl
24	Beige Basket Fabric & Vinyl
25	Red Basket Fabric & Vinyl
27	Turquoise Basket Fabric & Vinyl
32	Blue Crush—All Vinyl

TRIM (Continued)

Code	Trim Schemes
34	Beige Crush—All Vinyl
35	Red Crush—All Vinyl
37	Turquoise Crush—All Vinyl
39	Chestnut Crush—All Vinyl
45	Red Venice Fabric & Red Vinyl
54	Beige Steerhead—All Vinyl
56	Black Crush—All Vinyl
62	Blue Thong Plastic & Vinyl
63	Green Thong Plastic & Vinyl
72	Blue Pogo Stick Plastic & Vinyl
73	Green Pogo Stick Plastic & Vinyl
74	Beige Pogo Stick Plastic & Vinyl
75	Red Pogo Stick Plastic & Vinyl
77	Turq. Pogo Stick Plastic & Vinyl
85	Red Tweed—All Vinyl

DATE

The code letters for the month are preceded by a numeral to show the day of the month when the car was completed. The second year code letters are to be used if 1962 model production exceeds 12 months.

	First Model Year	Second Model Year
January	A	N
February	B	P
March	C	Q
April	D	R
May	E	S
June	F	T
July	G	U
August	H	V
September	J	W
October	K	X
November	L	Y
December	M	Z

DSO

Domestic Special Orders, Foreign Special Orders, and Pre-Approved Special Orders have the complete order number recorded in this space. If the unit is regular production, this space will remain blank.

AXLE

A number designates a conventional axle, while a letter designates an Equa-Lock differential.

Code	Ratio	Code	Ratio
1	3.00:1	A	3.00:1
6	3.56:1	F	3.56:1
8	3.89:1	H	3.89:1

TRANSMISSION

1	3-Speed Manual-Shift
2	Overdrive
3	Fordomatic
4	Cruise-O-Matic
5	4-Speed Manual-Shift

SERIAL NUMBER

Example (Fig. 1): 2S63X100001

2	1962 Year Model
S	Pilot Plant Assembly
63	2 Door Club Victoria
X	8-Cylinder 352 Cubic Inch Engine
100001	First Unit Built

MODEL YEAR

The number "2" designates 1962.

ASSEMBLY PLANT

A	**Atlanta**	**P**	**Twin City**
D	**Dallas**	**R**	**San Jose**
E	**Mahwah**	**S**	**Pilot Plant**
G	**Chicago**	**U**	**Louisville**
J	**Los Angeles**	**W**	**Wayne**
N	**Norfolk**		

MODEL

The model code number identifies the product line series and the particular body style: the first of the two digits shows the product line, and the second digit shows a two-door style **by an odd number** or a four-door style **by an even number.**

Galaxie—Series 50

51	2 Door Club Sedan
52	4 Door Town Sedan

Galaxie—Series 60

61	2 Door Club Sedan
62	4 Door Town Sedan
63	2 Door Club Victoria
64	4 Door Town Victoria
65	2 Door Convertible

Station Wagons—Series 70

71	4 Door Ranch Wagon
72	4 Door 6-Passenger Country Sedan
74	4 Door 9-Passenger Country Sedan
76	4 Door 6-Passenger Country Squire
78	4 Door 9-Passenger Country Squire

ENGINE

Code	
M	8-Cylinder 390 Cubic Inch (6-barrel High Performance)
Q	8-Cylinder 390 Cubic Inch (4-barrel High Performance)
R	8-Cylinder 390 Cubic Inch (4-barrel Low Compression Export, 84 Octane)
T	8-Cylinder 292 Cubic Inch (2-barrel Low Compression Export, 84 Octane)
V	6-Cylinder 223 Cubic Inch
W	8-Cylinder 292 Cubic Inch (2-barrel)
X	8-Cylinder 352 Cubic Inch (2-barrel)
Z	8-Cylinder 390 Cubic Inch (4-barrel)

CONSECUTIVE UNIT NUMBER

Each assembly plant, with each model year, begins with consecutive unit number 100001 and continues on for each car built.

1962 FORD GALAXIE SHOP MANUAL

GROUP 1

ENGINES AND EXHAUST SYSTEMS

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PART 1-1 GENERAL ENGINE SERVICE

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This part covers engine trouble diagnosis, tests, and adjustment procedures for all Ford Galaxie and Station Wagon engines. In addition, the cleaning, inspection, and reconditioning procedures are covered.

For engine removal, disassembly, assembly, installation, and repair procedures, refer to the part of this group which covers the applicable engine.

1 ENGINE TROUBLE DIAGNOSIS

Engine performance complaints usually fall under one of the basic headings listed in the "Engine Trouble Diagnosis Guide." When a particular trouble can not be traced to a definite cause by a simple check, the possible items that could be at fault are listed in the order of their probable occurrence. Check the items in the order listed. For example, under "Poor Acceleration," the ignition system is listed as a probable cause of the trouble. All the ignition system items that affect acceleration are listed. Check all these items before proceeding to the next probable cause.

ENGINE TROUBLE DIAGNOSIS GUIDE

ENGINE WILL NOT CRANK	The cause of this trouble is usually in the starting system (Part 11-2). If the starting system is not at fault, check for a hydrostatic lock or a seized engine as follows: Remove the spark plugs, then attempt to crank the engine with the starter. If the engine cranks, it indicates that water is leaking into the cylinders. Remove the cylinder head(s) and inspect the gasket(s) and/or head(s) for cracks. Examine the cylinder block for cracks.
ENGINE CRANKS NORMALLY, BUT WILL NOT START	Check the fuel supply. If there is sufficient fuel in the tank, the cause of the trouble probably lies in either the ignition or the fuel system. To determine which system is at fault, perform the following test: Disconnect a spark plug wire. Check the spark intensity at the end of the wire by installing a terminal adapter in the terminal of the wire to be checked. Then hold the adapter approximately 3/16 inch from the exhaust manifold and crank the engine. **IF THERE IS NO SPARK OR A WEAK SPARK AT THE SPARK PLUGS** The cause of the trouble is in the ignition system.	To determine if the cause of the trouble is in the primary or the secondary circuit, remove the coil high tension lead from the top of the distributor and hold it approximately 3/16 inch from the cylinder head. With the ignition on, crank the engine and check for a spark. If the spark at the coil high tension lead is good, the cause of the trouble is probably in the distributor cap or rotor. If there is no spark or a weak spark at the coil high tension lead, the cause of the trouble is probably in the primary circuit, coil to distributor high tension lead, or the coil.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE CRANKS NORMALLY, BUT WILL NOT START (Continued)	**IF THERE IS A GOOD SPARK AT THE SPARK PLUGS** Check the spark plugs. If the spark plugs are not at fault, check the following items: **MANUAL CHOKE** Check the choke linkage for binding or damage. Make certain the choke plate closes when the choke knob on the instrument panel is pulled out and that the plate opens when the knob is pushed in. **AUTOMATIC CHOKE** Check the position of the choke plate. If the engine is hot, the plate should be open. If the plate is not open, the engine will load up due to the excessively rich mixture and will not start. If the engine is cold, the plate should be closed. If the plate is not operating properly, check the following items: The choke linkage for binding. The fast idle cam for binding. Thermostatic spring housing adjustment. **FUEL SUPPLY AT THE CARBURETOR** Work the throttle by hand several times. Each time the throttle is actuated, fuel should spurt from the accelerating pump discharge nozzle(s). If fuel is discharged by the accelerating pump, the engine is probably flooded, or there is water in the fuel system, or an engine mechanical item is at fault. If fuel is not discharged by the accelerating pump, disconnect the carburetor fuel inlet line at the carburetor. Use a suitable container to catch the fuel. Crank the engine to see if fuel is reaching the carburetor. If fuel is not reaching the carburetor, check: The fuel filter. The fuel pump. The carburetor fuel inlet line for obstructions. The fuel pump flexible inlet line for a collapsed condition. The fuel tank line for obstructions. The fuel tank vent. If fuel is reaching the carburetor, check: The fuel inlet system including the fuel inlet needle and seat assembly and the float assembly.
ENGINE STARTS, BUT FAILS TO KEEP RUNNING	**FUEL SYSTEM** Idle fuel mixture needle(s) not properly adjusted. Engine idle speed set too low. The choke not operating properly. Float setting incorrect. Fuel inlet system not operating properly. Dirt or water in the fuel lines or in the fuel filter. Carburetor icing. Fuel pump defective. Check for dirt in the carburetor not allowing fuel to enter or be discharged from the idle system. **IGNITION SYSTEM** Leakage in the high tension wiring.	
ENGINE RUNS, BUT MISSES	Determine if the miss is steady or erratic and at what speed the miss occurs by operating the engine at various speeds under load. **MISSES STEADILY AT ALL SPEEDS** Isolate the miss by operating the engine with one cylinder not firing. This is done by operating the engine with the ignition wire removed from one spark plug at a time, until all cylinders have been checked. Ground the spark plug wire removed. If the engine speed changes when a particular cylinder is shorted out, that cylinder was delivering power before being shorted out. If no change in the engine operation is evident, the miss was caused by that cylinder not delivering power before being shorted out. In this case, check the: **IGNITION SYSTEM** If the miss is isolated in a particular cylinder, perform a spark test on the ignition lead of that cylinder. If a good spark does not occur, the trouble is in the secondary circuit of the system. Check the spark plug wire and the distributor cap.	

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE RUNS, BUT MISSES (Continued)	If a good spark occurs, check the spark plug. If the spark plug is not at fault, a mechanical component of the engine is probably at fault. **ENGINE** Perform a compression test to determine which mechanical component of the engine is at fault. **MISSES ERRATICALLY AT ALL SPEEDS** **EXHAUST SYSTEM** Exhaust system restricted. **IGNITION SYSTEM** Defective breaker points, condenser, secondary wiring, coil, or spark plugs. High tension leakage across the coil, rotor, or distributor cap. **FUEL SYSTEM** Float setting incorrect. Fuel inlet system not operating properly. Dirt or water in the fuel lines or carburetor. Restricted fuel filter. **COOLING SYSTEM** Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature. **ENGINE** Perform a compression test to determine which mechanical component of the engine is at fault. **MISSES AT IDLE ONLY** **FUEL SYSTEM** Idle fuel mixture needle(s) not properly adjusted. **IGNITION SYSTEM** Excessive play in the distributor shaft. Worn distributor cam. **ENGINE** Perform a compression test to determine which mechanical component of the engine is at fault. **MISSES AT HIGH SPEED ONLY** **FUEL SYSTEM** Power valve clogged or damaged. Low or erratic fuel pump pressure. Fuel inlet system not operating properly. Restricted fuel filter. **COOLING SYSTEM** Engine overheating.
ROUGH ENGINE IDLE	**FUEL SYSTEM** Engine idle speed set too low. Idle fuel mixture needle(s) not properly adjusted. Float setting incorrect. Air leaks between the carburetor, spacer, and the manifold and/or fittings. Fuel leakage at the carburetor fuel bowl(s). Power valve leaking fuel. Idle fuel system air bleeds or fuel passages restricted. Fuel bleeding from the accelerating pump discharge nozzle(s). Secondary throttle plate(s) not closing (4-barrel carburetor). Improper secondary throttle plate stop adjustment (4 - barrel carburetor). Incorrect idle speed setting of the secondary carburetors (390 Super High Performance V-8). Leaking fuel pump, lines, or fittings. **IGNITION SYSTEM** Improperly adjusted or defective breaker points. Fouled or improperly adjusted spark plugs. Incorrect ignition timing. Spark plug misfiring. **EXHAUST SYSTEM** Exhaust gas control valve inoperative or sticking. **ENGINE** Loose engine mounting bolts or worn insulator. Cylinder head bolts not properly torqued. Valve lash set too tight (engines with mechanical valve lifters). Crankcase ventilation regulator valve defective or a restricted tube (Positive Crankcase Ventilation System).

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

POOR ACCELERATION	**IGNITION SYSTEM** Incorrect ignition timing. Fouled or improperly adjusted spark plugs. Improperly adjusted or defective breaker points. Distributor not advancing properly. **FUEL SYSTEM** Inoperative accelerating pump inlet ball check. Inoperative accelerating pump discharge ball check. Accelerating pump diaphragm defective. Float setting incorrect. Throttle linkage not properly adjusted. Accelerating pump stroke not properly adjusted.	Leaky power valve, gaskets, or accelerating pump diaphragm. Dirt or corrosion in accelerating system. Distributor vacuum passages in the carburetor blocked. Restricted fuel filter. **EXHAUST SYSTEM** Exhaust gas control valve stuck closed. **BRAKES** Improper adjustment. **TRANSMISSION** Clutch slippage (manual - shift transmissions). Improper band adjustment (automatic transmissions). Converter One-Way Clutch (automatic transmissions).
ENGINE DOES NOT DEVELOP FULL POWER, OR HAS POOR HIGH SPEED PERFORMANCE	**FUEL SYSTEM** Restricted air cleaner. Restricted fuel filter. Clogged or undersize main jets and/or low float setting. Clogged or undersize secondary jets (4-barrel carburetor). Power valve clogged or damaged. Secondary throttle plates not opening (4-barrel carburetor). Fuel pump pressure incorrect. Distributor vacuum passage in the carburetor blocked. **IGNITION SYSTEM** Ignition timing not properly adjusted. Defective coil, condenser, or rotor. Distributor not advancing properly. Excessive play in the distributor shaft. Distributor cam worn. Fouled or improperly adjusted spark plugs.	Improperly adjusted or defective breaker points. **EXHAUST SYSTEM** Exhaust gas control valve inoperative or sticking. Restriction in exhaust system. **COOLING SYSTEM** Thermostat inoperative or incorrect heat range. Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature. **ENGINE** Perform an engine compression test to determine which mechanical component of the engine is at fault. One or more camshaft lobes worn beyond wear limit. **TRANSMISSION** Improper band adjustment (automatic transmissions).
EXCESSIVE FUEL CONSUMPTION	Determine the actual fuel consumption with test equipment installed in the car. If the test indicates that the fuel consumption is not excessive, demonstrate to the owner how improper driving habits will affect fuel consumption. If the test indicates that the fuel consumption is excessive, make a	preliminary check of the following items before proceeding to the fuel and ignition systems. **PRELIMINARY CHECKS** **CHASSIS ITEMS** Check: Tires for proper pressure. Front wheel alignment. Brake adjustment.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

EXCESSIVE FUEL CONSUMPTION (Continued)	**EXHAUST SYSTEM** Check the exhaust gas control valve operation. System restricted. **ODOMETER** Check calibration. **IGNITION SYSTEM** Check: Distributor breaker points. Ignition timing. **ENGINE** Crankcase ventilation regulator valve defective or restricted tubes (Positive Crankcase Ventilation System). **FINAL CHECKS** **FUEL SYSTEM** Check: Fuel pump pressure. Engine idle speed. Idle fuel mixture needle(s) for proper adjustment. Automatic choke for proper operation. Fast idle speed screw for proper adjustment. Accelerating pump stroke adjustment.	Anti-stall dashpot for proper adjustment. Air cleaner for restrictions. Float setting or fuel level. Jets for wear and/or damage. Power valve operation. Air bleeds for obstructions. Accelerating pump discharge nozzles for siphoning. Spark control valve for proper seating. Accelerator linkage for binds. Choke adjustment. **IGNITION SYSTEM** Check: Spark plug condition and adjustment. Distributor spark advance operation. **ENGINE** Perform an engine compression test to determine which mechanical component of the engine is at fault. Check valve lash adjustment (engines with mechanical valve lifters). **COOLING SYSTEM** Check thermostat operation and heat range. **TRANSMISSION** Check band adjustment (automatic transmissions).
ENGINE OVERHEATS	**TEMPERATURE SENDING UNIT AND GAUGE** Unit or gauge defective (not indicating correct temperature), or constant voltage regulator defective. **ENGINE** Cylinder head bolts not properly torqued. Incorrect valve lash (engines with mechanical valve lifters). Low oil level or incorrect viscosity oil used.	**COOLING SYSTEM** Insufficient coolant. Cooling system leaks. Drive belt tension incorrect. Radiator fins obstructed. Thermostat defective. Thermostat improperly installed. Cooling system passages blocked. Water pump inoperative. Faulty fan drive. **IGNITION SYSTEM** Incorrect ignition timing.
LOSS OF COOLANT	**COOLING SYSTEM** Leaking radiator. Loose or damaged hose connections. Water pump leaking. Radiator cap defective. Overheating. **ENGINE** Cylinder head gasket defective. Intake manifold to cylinder head	gasket defective. Cylinder head or intake manifold bolts not properly torqued. Cylinder block core plugs leaking. Temperature sending unit leaking. Cracked cylinder head or block, or warped cylinder head or block gasket surface.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE	**TEMPERATURE SENDING UNIT AND GAUGE** Unit or gauge defective (not indicating correct temperature) or constant voltage regulator defective.	**COOLING SYSTEM** Thermostat inoperative or of incorrect heat range.
NOISY HYDRAULIC VALVE LIFTER	A noisy hydraulic valve lifter can be located by operating the engine at idle speed and placing a finger on the face of the valve spring retainer. If the lifter is not functioning properly, a shock will be felt when the valve seats. Another method of identifying a noisy lifter is by the use of a piece of hose. With the engine operating at idle speed, place one end of the hose near the end of the valve stem and the other end to the ear and listen for a metallic noise. Repeat this procedure on each intake and exhaust valve until the noisy lifter(s) has been located. The most common causes of hydraulic valve lifter troubles are dirt, gum, varnish, carbon deposits, and air bubbles. Dirt in the lifter assembly can prevent the disc valve from seating, or it may become lodged between the plunger and body surfaces. In either case, the lifter becomes inoperative due to failure to "pump-up," or because the internal parts are no longer free to function properly. When dirt is found to be responsible for lifter malfunction, remove the lifter assembly and thoroughly clean it. Recommended engine oil and filter change intervals should be followed to minimize lifter problems caused by dirt. Deposits of gum and varnish cause similar conditions to exist which may result in lifter malfunction. If these conditions are found to be present, the lifter should be disassembled and cleaned in solvent to remove all traces of deposits. Air bubbles in the lubricating oil, caused by an excessively high or low oil level, may likewise cause lifter malfunction. A damaged oil pick-up tube may allow air to be drawn into the lubricating system. To check for the presence of air, remove a valve rocker arm cover and note the condition of the oil as it flows from the valve rocker arm shaft assembly. Perform corrective action as required to remove air from the lubricating oil.	
SILENT VALVE MECHANISM	**MALFUNCTIONING OR SLUGGISHLY OPERATING ECCENTRIC** A properly operating eccentric should compensate for variation in the adjustment screw within 30 seconds at approximately 1000 engine rpm. To determine if the eccentric is operating correctly, operate the engine at 1000 rpm. Slowly vary the position of the adjustment screw to change the operating range of the eccentric. The eccentric should move in and out to compensate for the turning of the adjustment screw within 30 seconds. If it does not, check to see if the eccentric is properly installed and/or if it has reached the limit of its travel, with the eccentric against the stop on the rocker arm. When the screw is turned, the valve may be held open for a short period of time. This is normal and will close after the eccentric has operated long enough to compensate. If it does not compensate in the specified time, replace the eccentric.	**EXCESSIVE VALVE NOISE** Check the adjustment of the rocker arm eccentric. If the eccentric is out of adjustment, check the related parts for abnormal wear, then adjust the eccentric. Check the eccentric operation as explained under "Malfunctioning or Sluggishly Operating Eccentric." If the operation is unsatisfactory, replace the parts as necessary.

2 ENGINE TESTS AND ADJUSTMENTS

PRELIMINARY (COLD) VALVE LASH—MECHANICAL VALVE LIFTERS

If the valve rocker arm shaft assembly has been removed and installed, it will be necessary to make a preliminary (cold) valve lash adjustment before starting the engine. If the adjustment is made for an engine tune-up, follow the final adjustment procedure.

The cylinders are numbered from front to rear—right bank, 1-2-3-4; left bank, 5-6-7-8.

On the 292 V-8, the valves are arranged from front to rear on both banks, E-I-I-E-E-I-I-E.

On the 390 V-8 engines, the valves are arranged from front to rear on both banks, E-I-E-I-I-E-I-E.

1. Turn all the valve adjusting screws until interference is noted. Check the torque required to turn the screw further. If the torque required to turn a screw is less than 3 ft-lbs (36 in-lbs), try a new self-locking adjusting screw. If this is still unsatisfactory, replace the rocker arm and adjusting screws.

2. Make three chalk marks on the crankshaft damper (Fig. 1). Space the marks approximately 90° apart so that with the timing mark, the damper is divided into four equal parts (90° represents 1/4 of the distance around the damper circumference). Set the intake and exhaust valve lash to specifications.

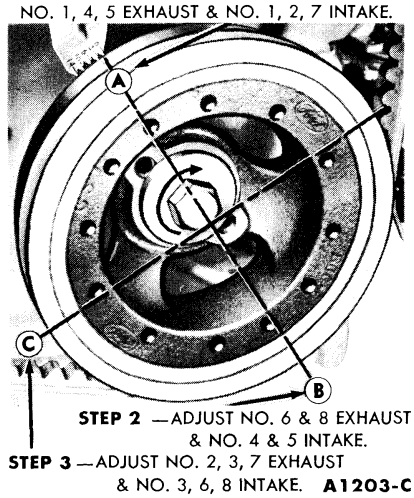
STEP 1 —SET NO. 1 PISTON ON T. D. C. AT END OF COMPRESSION STROKE. —ADJUST NO. 1, 4, 5 EXHAUST & NO. 1, 2, 7 INTAKE.
A
C
B
STEP 2 —ADJUST NO. 6 & 8 EXHAUST & NO. 4 & 5 INTAKE.
STEP 3 —ADJUST NO. 2, 3, 7 EXHAUST & NO. 3, 6, 8 INTAKE. A1203-C

FIG. 1—V-8 Preliminary Valve Lash Adjustment

3. Rotate the crankshaft until No. 1 piston is near TDC at the end of the compression stroke. Adjust the following valves:

No. 1 Exhaust	No. 2 Intake (292 V-8)
No. 4 Exhaust	
No. 5 Exhaust	No. 7 Intake
No. 1 Intake	No. 8 Intake (390 V-8)

4. Rotate the crankshaft 180° or ½ turn in the direction shown in Fig. 1 (this puts No. 4 piston on TDC). Adjust the following valves:

No. 2 Exhaust (390 V-8)	No. 8 Exhaust
	No. 4 Intake
No. 6 Exhaust (292 V-8)	No. 5 Intake

5. Rotate the crankshaft another ¾ turn in the same direction (this puts No. 3 piston on TDC). Adjust the following valves:

No. 2 Exhaust (292 V-8)	No. 2 Intake (390 V-8)
No. 3 Exhaust	No. 3 Intake
No. 7 Exhaust	No. 6 Intake
No. 8 Exhaust (390 V-8)	No. 8 Intake (292 V-8)

VALVE LASH (HOT)—MECHANICAL VALVE LIFTERS

It is very important that the valve lash be held to the correct specifications because:

If the lash is set too close, the valve will open too early and close too late, resulting in rough engine idle. Burning and warping of the valves will occur also because the valves cannot make firm contact with the seats long enough to cool properly. If the lash is excessive, it will cause the valve to open too late and close too early causing valve bounce. In addition, damage to the camshaft lobe is likely because the tappet foot will not follow the pattern of the camshaft lobe causing a shock contact between these two parts.

1. Be sure the engine is at normal operating temperature before attempting to set the valve lash.

2. With the engine idling, set the valve lash (Fig. 2) using a step-type feeler gauge only ("go" and "no go"). The final (hot) intake and exhaust valve lash settings are listed in the Specification Section.

For example, to obtain the correct setting if the valve lash is 0.019 inch, use a step-type feeler gauge of 0.018 inch ("go") and 0.020 inch ("no go"). The "go" step should enter, and the "no go" step should not enter. The resultant setting will be to the required setting (0.019 inch).

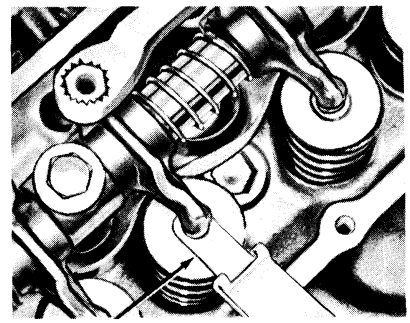

FIG. 2—Valve Lash Adjustment —Mechanical Valve Lifters

VALVE CLEARANCE—HYDRAULIC VALVE LIFTERS

A 0.060-inch shorter push rod (color coded white) or a 0.060-inch longer push rod (color coded yellow) are available for service to provide a means of compensating for dimensional changes in the valve mechanism. Valve stem to valve rocker arm clearance should be to the specified clearance with the hydraulic lifter completely collapsed. Repeated valve reconditioning operations (valve and/or valve seat refacing) will decrease the clearance to the point that if not compensated for, the hydraulic valve lifter will cease to function. To determine whether a shorter or a longer push rod is necessary, make the following check:

1. Position the crankshaft as outlined in steps 2 and 3. Position the hydraulic lifter compressor tool on the rocker arm and slowly apply pressure to bleed down the hydraulic lifter until the plunger is completely bottomed (Fig. 3). Hold the lifter in the fully collapsed position and insert the clearance gauge (Fig. 3) between the valve stem and the rocker arm of the valve being checked. If the first step of the gauge enters, the old push rod may be used. If the first step will not enter, replace the standard push rod with a shorter service push rod. If the second step of the gauge enters, the operating range of the lifter is excessive which indicates that the incorrect push rod has been in-

stalled or severe wear has occurred at the push rod ends, rocker arm, or valve stem. In this case, it will be necessary to determine the area of discrepancy and the incorrect or defective part(s) should be replaced. If all the valve train components except the push rod are within limits, install a 0.060-inch longer push rod.

2. Rotate the crankshaft until No. 1 piston is on TDC at the end of the compression stroke. With No. 1 piston on TDC, check the following valves:

No. 1 Intake	No. 1 Exhaust
No. 3 Intake	No. 4 Exhaust
No. 7 Intake	No. 5 Exhaust
No. 8 Intake	No. 8 Exhaust

3. After these valves have been checked, position No. 6 piston on TDC and check the following valves:

No. 2 Intake	No. 2 Exhaust
No. 4 Intake	No. 3 Exhaust
No. 5 Intake	No. 6 Exhaust
No. 6 Intake	No. 7 Exhaust

When compressing the valve spring to remove push rods, be sure the piston in the individual cylinder is below TDC to avoid contact between the valve and the piston.

To replace a push rod, it will be necessary to remove the valve rocker arm shaft assembly (Part 1-4).

Upon replacement of a valve push rod and/or valve rocker arm shaft assembly, the engine should not be cranked or rotated until the hydraulic lifters have had an opportunity to leak down to their normal operating position. The leakdown rate can be accelerated by using the tool shown in Fig. 3 on the valve rocker arm and applying

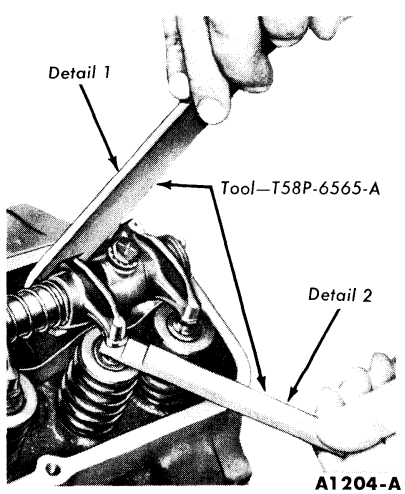

FIG. 3—Valve Clearance—Hydraulic Valve Lifters

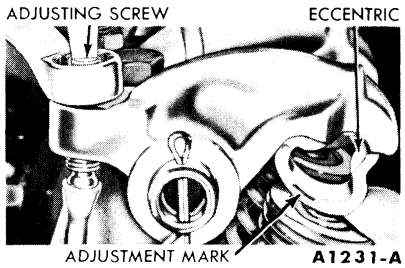

FIG. 4—Depressing Valve Rocker Arm Eccentric

pressure in a direction to collapse the lifter.

VALVE CLEARANCE—SILENT VALVE MECHANISM

The silent lash rocker arm is adjusted with the engine not operating.

1. Remove the valve rocker arm cover.

2. Position the No. 1 piston at TDC at the end of the compression stroke.

3. Adjust the intake and exhaust rocker arm for the No. 1 cylinder. Push the eccentric toward the rocker arm until the plunger is completely pushed into its bore in the rocker arm (Fig. 4). Turn the adjusting screw in until the eccentric and plunger are held in the depressed position (Fig. 4).

4. Slowly turn the adjusting screw out until the adjustment mark on the eccentric is centered over the valve stem (Fig. 5). Torque the lock nut to specifications to lock the adjustment. The correct position of the adjustment mark is shown in Fig. 6.

5. Repeat steps 3 and 4 on the remaining sets of rocker arms. Position the piston in each cylinder following the firing order (1-5-3-6-2-4) on TDC after the compression stroke and adjust the rocker arms (intake and exhaust). To position the individual pistons on TDC in the firing order, turn the damper approximately ⅓ turn at a time, in the direction of rotation. This procedure requires two complete turns of the crankshaft.

6. After all the rocker arms have been adjusted, start the engine and operate it at normal idle speed. Observe the position of the adjustment mark on each eccentric. Make minor adjustments, as necessary, with the engine idling by turning the adjusting screws in or out as necessary.

7. After making the minor adjustments, stop the engine and install the valve rocker arm cover.

CAMSHAFT LOBE LIFT

1. Remove the air cleaner and the valve rocker arm cover(s).

On an engine with mechanical valve lifters or on the Mileage Maker Six, slide the rocker arm assembly serving the camshaft lobe to be checked to one side. Secure it in this position. To move the rocker arm on either end of the shaft, it will be necessary to remove the retaining pin and washers and slide the rocker arm off the shaft.

On an engine with hydraulic valve lifters, remove the valve rocker arm shaft assembly and install a solid tappet-type push rod in the push rod bore of the camshaft lobe to be checked.

2. Make sure the push rod is in the tappet socket or the lifter push rod cup. Install a dial indicator in such a manner as to have the actuating point of the indicator in the push rod socket and in the same plane as the push rod movement (Fig. 7 or 8).

3. Turn the crankshaft damper slowly in the direction of rotation until the tappet or lifter is on the base circle of the camshaft lobe. At this point, the push rod will be in its lowest position.

4. Zero the dial indicator. Continue to rotate the damper slowly until the push rod is in the fully raised position.

5. Compare the total lift recorded on the indicator with specifications.

6. To check the accuracy of the original indicator reading, continue to rotate the damper until the indicator reads zero.

7. Remove the dial indicator.

On an engine with mechanical valve lifters or on the Mileage Maker

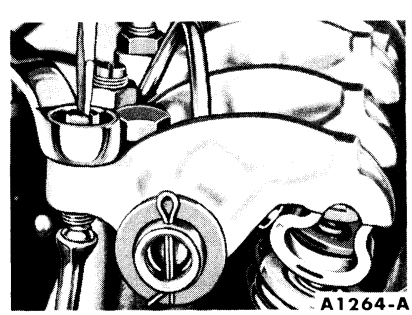

FIG. 5—Aligning Eccentric Mark

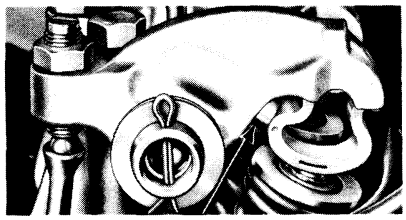

FIG. 6—Correct Position of Eccentric

Six, position the valve rocker arm. If an end valve rocker arm was removed, slide it into position on the shaft and install the washers and retaining pin. Perform a preliminary valve lash adjustment as necessary. Operate the engine until normal operating temperature has been reached. Check and adjust the valve lash or Silent Lash clearance.

On an engine with hydraulic valve lifters, install the valve rocker arm shaft.

8. Install the valve rocker arm cover(s) and the air cleaner.

MANIFOLD VACUUM TEST

A manifold vacuum test aids in determining the condition of an engine and also in helping to locate the cause of poor engine performance. To test manifold vacuum:

1. Operate the engine for a minimum of 30 minutes at 1200 rpm.

2. Install an accurate, sensitive vacuum gauge in the intake manifold fitting.

3. Operate the engine at recommended idle rpm, with the transmission selector lever in neutral.

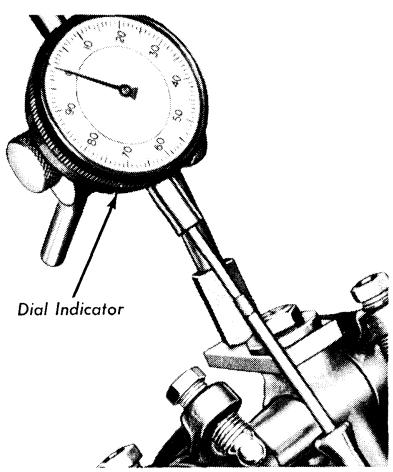

FIG. 7—Camshaft Lobe Lift—Mechanical Valve Lifters

4. Check the vacuum reading on the gauge.

TEST CONCLUSIONS

Manifold vacuum is affected by carburetor adjustment, valve timing, the condition of the valves, cylinder compression, and leakage of the manifold, carburetor, or cylinder head gaskets.

Because abnormal gauge readings may indicate that more than one of the above factors is at fault, exercise caution in analyzing an abnormal reading. For example, if the vacuum is low, the correction of one item may increase the vacuum enough so as to indicate that the trouble has been corrected. It is important, therefore, that each cause of an abnormal reading be investigated and further tests conducted where necessary in order to arrive at the correct diagnosis of the trouble.

Table 1 lists various types of readings and their possible causes.

Allowance should be made for the effect of altitude on the gauge reading. The engine vacuum will decrease with an increase in altitude.

TABLE 1—Manifold Vacuum Gauge Readings

Gauge Reading	Engine Condition
18 inches—All engines.	Normal.
Low and steady.	Loss of power in all cylinders caused possibly by late ignition or valve timing, or loss of compression due to leakage around the piston rings.
Very low.	Manifold, carburetor, spacer, or cylinder head gasket leak.
Needle fluctuates steadily as speed increases.	A partial or complete loss of power in one or more cylinders caused by a leaking valve, cylinder head or intake manifold gasket leak, a defect in the ignition system, or a weak valve spring.
Gradual drop in reading at engine idle.	Excessive back pressure in the exhaust system.
Intermittent fluctuation.	An occasional loss of power possibly caused by a defect in the ignition system or a sticking valve.
Slow fluctuation or drifting of the needle.	Improper idle mixture adjustment, carburetor, spacer, or intake manifold gasket leak.

COMPRESSION TEST

1. Be sure the battery is properly charged. Operate the engine for a minimum of 30 minutes at 1200 rpm. Turn the ignition switch off, then remove all the spark plugs. Remove the coil high tension lead at the distributor cap.

2. Set the throttle plates (primary throttle plates only on a 4-barrel carburetor) and choke plate in the wide open position.

3. Install a compression gauge in No. 1 cylinder.

4. Using a remote starter switch, crank the engine several times and record the highest reading recorded. Note the number of compression strokes required to obtain the highest reading.

5. Repeat the test on each cylinder, cranking the engine the same number of times for each cylinder as was required to obtain the highest reading on the No. 1 cylinder.

TEST CONCLUSIONS

A variation of ± 20 pounds from specified pressure is satisfactory.

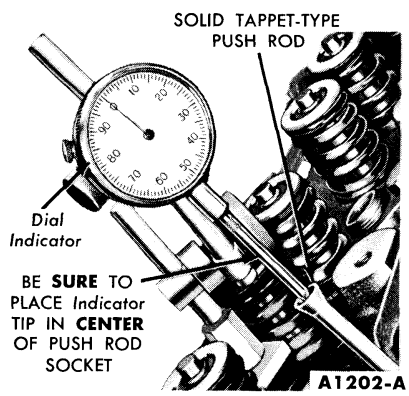

FIG. 8—Camshaft Lobe Lift—Hydraulic Lifters

However, the compression of all cylinders should be uniform within 10 pounds.

A reading of more than the allowable tolerance above normal indicates excessive deposits in the cylinder.

A reading of more than the allowable tolerance below normal indicates leakage at the cylinder head gasket, piston rings, or valves.

A low even compression in two adjacent cylinders indicates a cylinder head gasket leak. This should be checked before condemning the rings or valves.

To determine whether the rings or the valves are at fault, squirt the equivalent of a tablespoon of heavy oil into the combustion chamber. Crank the engine to distribute the oil and repeat the compression test. The oil will temporarily seal leakage past the rings. If approximately the same reading is obtained, the rings are satisfactory, but the valves are leaking. If the compression has increased 10 pounds or more over the original reading, there is leakage past the rings.

During a compression test, if the pressure fails to climb steadily and remains the same during the first two successive strokes, but climbs higher on the succeeding strokes, or fails to climb during the entire test, it indicates a sticking valve.

3 CLEANING, INSPECTION, AND RECONDITIONING

INTAKE MANIFOLD

Clean the manifold in a suitable solvent. Dry it with compressed air.

Inspect the manifold for cracks, leaks, or other defects that would make it unfit for further service. Replace all studs that are stripped or otherwise damaged. **Remove all filings and foreign matter that may have entered the manifold as a result of repairs.**

On the 352 and 390 V-8 engines, check the baffle plate on the underside of the manifold for looseness and be sure the maze screen is in place. Clean off any varnish.

EXHAUST MANIFOLDS

Inspect the manifolds for cracks, leaks, or other defects that would make them unfit for further service.

On the right exhaust manifold of the 352 and 390 V-8 engines, make sure the automatic choke air inlet and outlet holes are completely open and the cover does not leak. Blow out the automatic choke air heat tube with compressed air.

VALVE ROCKER ARM SHAFT ASSEMBLY

CLEANING AND INSPECTION

Clean all the parts thoroughly. Make sure all oil passages are open.

Check the clearance between each rocker arm and the shaft by checking the ID of the rocker arm bore and the OD of the shaft. If the clearance between any rocker arm and the shaft exceeds the wear limit, replace the shaft and/or the rocker arm. Inspect the shaft and the rocker arm bore for nicks, scratches, scores, or scuffs.

Inspect the pad at the valve end of the rocker arms for a grooved radius.

Check for broken locating springs.

On engines with mechanical or silent lash valve lifters, check the rocker arm adjusting screws and the push rod end of the rocker arms for stripped or broken threads, and the ball end of the adjusting screw for nicks, scratches, or excessive wear. Inspect the oil tubes for cracks or sharp bends.

On the Mileage Maker Six, inspect the eccentric for abnormal wear in the area of contact with the valve stem tip and the rocker arm bearing recess. Inspect the eccentric bearing recess machined in the rocker arm. Evidence of wear in this area can best be determined by measuring the length of the inner slot or relief area machined in the cavity (Fig. 9). Using a divider, measure the length of the slot. Take the measurement perpendicular to the arm axis. If the slot length has decreased to or below the recommended minimum, replace the arm.

REPAIRS

Dress up minor surface defects on the shaft and in the rocker arm bore with a hone.

On engines with mechanical or silent lash valve lifters, if the pad at the valve end of the rocker arm has a grooved radius, replace the rocker arm. **Do not attempt to true this surface by grinding.**

PUSH RODS

INSPECTION

Check the ends of the push rods for nicks, grooves, roughness, or excessive wear.

The push rods can be visually checked for straightness while they are installed in the engine by rotating them with the valve closed.

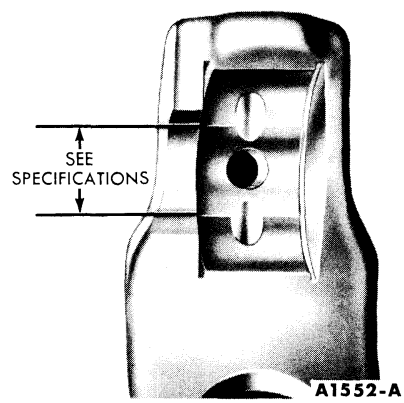

FIG. 9—Silent Lash Rocker Measurement

They also can be checked with a dial indicator (Fig. 10).

REPAIRS

If the runout exceeds the maximum limit at any point, discard the rod. **Do not attempt to straighten push rods.**

CYLINDER HEADS

CLEANING

With the valves installed to protect the valve seats, remove deposits from the combustion chambers and valve heads with a scraper and a wire brush. **Be careful not to damage the cylinder head gasket surface.** After the valves are removed, clean the valve guide bores with a valve

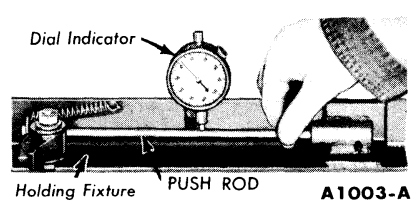

FIG. 10—Push Rod Runout

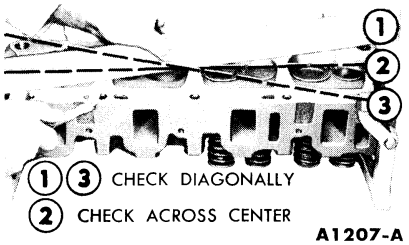

FIG. 11—Cylinder Head Flatness

guide cleaning tool. Use cleaning solvent to remove dirt, grease, and other deposits.

INSPECTION

Check the cylinder head for cracks, and the gasket surface for burrs and nicks. Replace the head if it is cracked.

Cylinder Head Flatness. Check the flatness of the cylinder head gasket surface (Fig. 11).

Valve Seat Runout. Check the valve seat runout with an accurate gauge (Fig. 12). Follow the instructions of the gauge manufacturer. If the runout exceeds the wear limit, reface the valve and valve seat.

Valve Seat Width. Measure the valve seat width (Fig. 13).

REPAIRS

Replace the head if it is cracked. **Do not plane or grind more than 0.010 inch from the cylinder head gasket surface.** Remove all burrs or scratches with an oil stone.

Reaming Valve Guides. If it becomes necessary to ream a valve guide (Fig. 14) to install a valve with an oversize stem, a reaming kit is available which contains the following reamer and pilot combinations: a 0.003-inch O.S. reamer with a

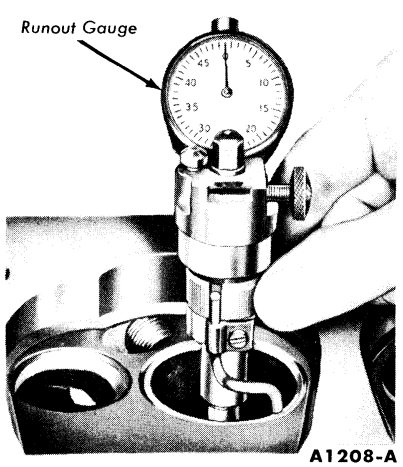

FIG. 12—Valve Seat Runout

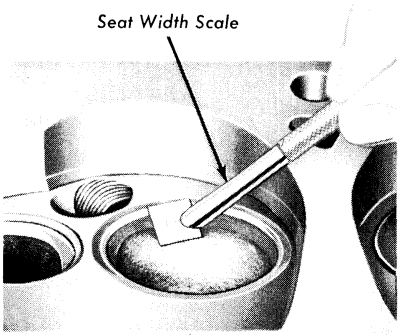

FIG. 13—Valve Seat Width

standard diameter pilot, a 0.015-inch O.S. reamer with a 0.003-inch O.S. pilot, and a 0.030-inch reamer with a 0.015-inch O.S. pilot.

When going from a standard size valve to an oversize valve, always use the reamers in sequence. **Always reface the valve seat after the valve guide has been reamed.**

Refacing Valve Seats. Refacing of the valve seats should be closely coordinated with the refacing of the valve face so that the finished seat will match the valve face and be centered. This is important so that the valve and seat will have a good compression tight fit. Be sure that the refacer grinding wheels are properly dressed.

Grind the valve seats of all engines to a true 45° angle (Fig. 15). Remove only enough stock to clean up pits, grooves, or to correct the valve seat runout. After the seat has been refaced, measure the seat width (Fig. 13). Narrow the seat, if necessary, to bring it within limits.

If the valve seat width exceeds the maximum limit, remove enough stock from the top edge and/or bottom edge of the seat to reduce

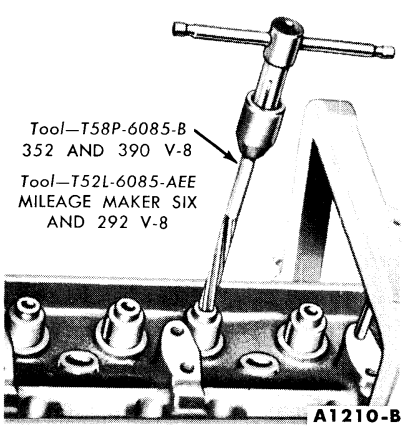

FIG. 14—Reaming Valve Guides

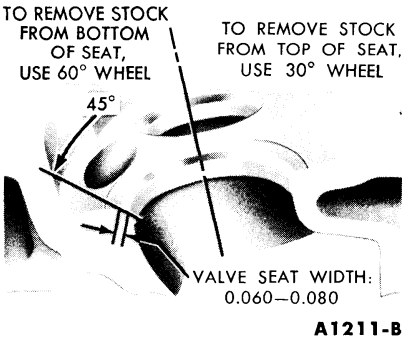
TO REMOVE STOCK FROM BOTTOM OF SEAT, USE 60° WHEEL
TO REMOVE STOCK FROM TOP OF SEAT, USE 30° WHEEL
45°
VALVE SEAT WIDTH: 0.060—0.080
A1211-B

FIG. 15—Valve Seat Refacing

the width to specifications (Fig. 13).

On the valve seats of all engines, use a 60° angle grinding wheel to remove stock from the bottom of the seats (raise the seats) and use a 30° angle wheel to remove stock from the top of the seats (lower the seats).

The finished valve seat should contact the approximate center of the valve face. It is good practice to determine where the valve seat contacts the face. To do this, coat the seat with Prussian blue, then set the valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of the valve face, the contact is satisfactory. If the blue is transferred to the top edge of the valve face, lower the valve seat. If the blue is transferred to the bottom edge of the valve face, raise the valve seat.

VALVES

CLEANING

Remove all deposits from the valve with a fine wire brush or buffing wheel.

INSPECTION

The critical inspection points and tolerances of the valves are illustrated in Fig. 16.

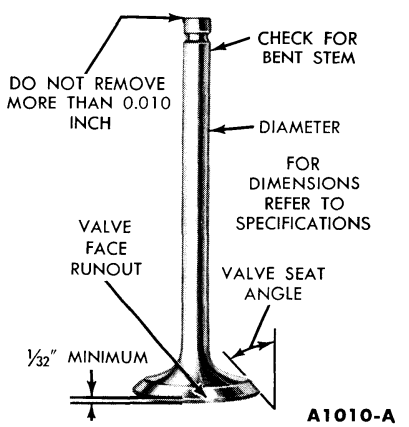

FIG. 16—Critical Valve Tolerances

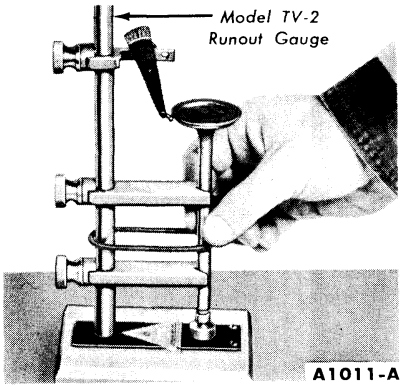

FIG. 17—Valve Face Runout

Inspect the valve face and the edge of the valve head for pits, grooves, scores, or other defects. Inspect the stem for a bent condition and the end of the stem for grooves or scores. Check the valve head for signs of burning or erosion, warpage, and cracking.

Inspect the valve springs, valve spring retainers, locks, and sleeves for defects.

Valve Face Runout. Check the valve face runout (Fig. 17). It should not exceed the wear limit.

Valve Stem Clearance. Check the valve stem to valve guide clearance of each valve in its respective valve guide with the tool shown in Fig. 18 or its equivalent. Use a flat-end indicator point.

Valve Spring Pressure. Check the spring for proper pressure (Fig. 19). Do not remove the damper spring if one is installed when checking the pressure. Weak valve springs cause poor engine performance.

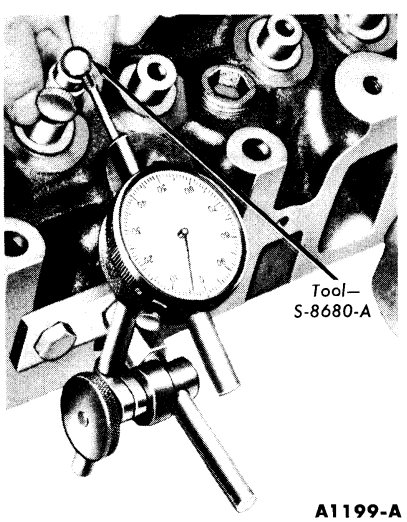

FIG. 18—Valve Stem Clearance

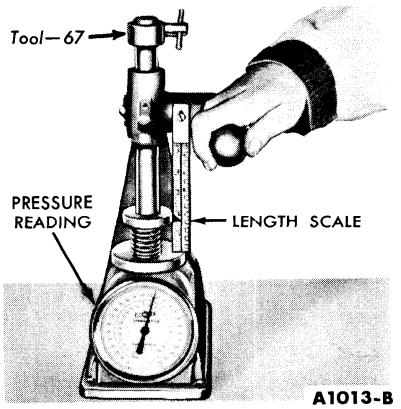

FIG. 19—Valve Spring Pressure

Valve Spring Squareness. Check each spring for squareness, using a steel square and a surface plate (Fig. 20). Stand the spring and square on end on the surface plate. Slide the spring up to the square. Revolve the spring slowly and observe the space between the top coil of the spring and the square. The out-of-square limit is 1/16 inch.

REPAIRS

Valve defects, such as minor pits, grooves, etc. may be removed. Discard valves that are severely damaged, or if the face runout or stem clearance exceed specifications.

Discard any defective part of the valve assembly.

Refacing Valves. The valve refacing operation should be closely coordinated with the valve seat refacing operation so that the finished angle of the valve face will match the valve seat. This is important so that the valve and seat will have a good compression tight fit. Be sure that the refacer grinding wheels are properly dressed.

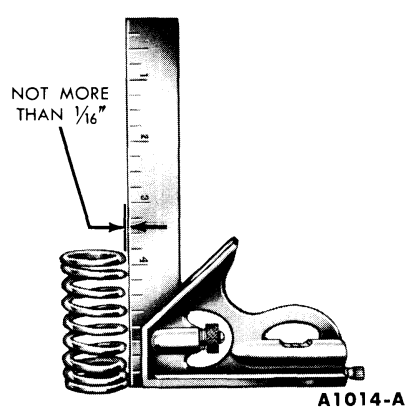

FIG. 20—Valve Spring Squareness

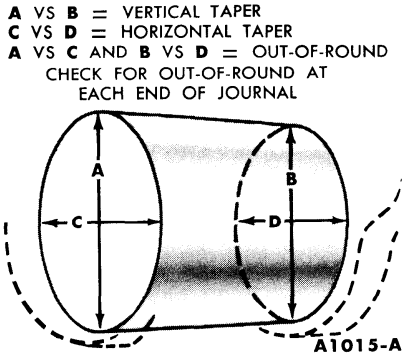

FIG. 21—Crankshaft Journal Measurements

If the valve face runout is excessive and/or to remove pits and grooves, reface the valves to a true 44° angle. Remove only enough stock to correct the runout or to clean up the pits and grooves. If the edge of the valve head is less than 1/32 inch after grinding, replace the valve as the valve will run too hot in the engine.

On engines with hydraulic valve lifters, if the valve and/or valve seat has been refaced, it will be necessary to check the clearance between the rocker arm pad and the valve stem with the valve train assembly installed in the engine.

Select Fitting Valves. If the valve stem to valve guide clearance exceeds the wear limit, ream the valve guide for the next oversize valve stem. Valves with oversize stem diameters of 0.003, 0.015, and 0.030 inch are available for service. Refer to "Reaming Valve Guides."

HYDRAULIC VALVE LIFTERS

The lifter assemblies should be kept in proper sequence so that they can be installed in their original position. Inspect and test each lifter separately so as not to intermix the internal parts. **If any part of the lifter assembly needs replacing, replace the entire assembly.**

CLEANING AND INSPECTION

Thoroughly clean all the parts in clean solvent and wipe them with a clean, lint-free cloth.

Inspect the parts and discard the entire lifter assembly if any part shows signs of pitting, scoring, galling, or evidence of non-rotation. Replace the entire assembly if the plunger is not free in the body. The plunger should drop to the bottom of the body by its own weight.

Assemble the lifter assembly and check for freeness of operation by pressing down on the push rod cup. The lifters can also be checked with a hydraulic tester to test the leak-down rate. Follow the instructions of the test unit manufacturer.

TIMING CHAIN

Clean all parts in solvent and dry them with compressed air. Inspect the chain for broken links and the sprockets for cracks, and worn or damaged teeth. Replace all the components if any one item needs replacement.

CAMSHAFT

CLEANING AND INSPECTION

Clean the camshaft in solvent and wipe dry. Inspect the camshaft lobes for scoring, and signs of abnormal wear. Lobe wear characteristics may result in pitting in the general area of the lobe. This pitting is not detrimental to the operation of the camshaft, therefore, the camshaft should not be replaced until the lobe lift loss has exceeded 0.005 inch.

The lift of camshaft lobes can only be checked with the camshaft installed in the engine. Refer to "Camshaft Lobe Lift."

Check the distributor drive gear for broken or chipped teeth.

REPAIRS

Remove light scuffs, scores, or nicks from the camshaft machined surfaces with a smooth oil stone.

CRANKSHAFT

CLEANING

Handle the crankshaft with care to avoid possible fractures or damage to the finished surfaces. Clean the crankshaft with solvent, then blow out all oil passages with compressed air.

INSPECTION

Inspect main and connecting rod journals for cracks, scratches, grooves, or scores.

Measure the diameter of each journal in at least four places to determine out-of-round, taper, or undersize condition (Fig. 21).

On engines used with a manual-shift transmission, check the fit of the clutch pilot bushing in the bore of the crankshaft. The bushing is pressed into the crankshaft and

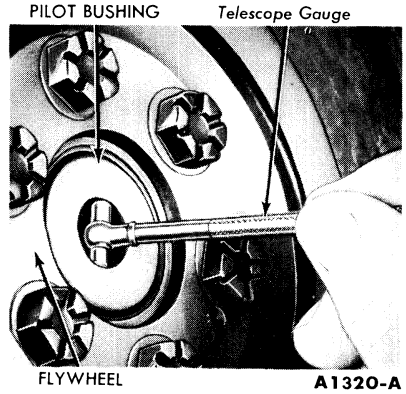

FIG. 22—Clutch Pilot Bushing Wear Check

should not be loose. Inspect the inner surface of the bushing for wear or a bell-mouth condition. Check the ID of the bushing (Fig. 22). Replace the bushing if worn or damaged.

Inspect the pilot bearing, when used, for roughness, evidence of overheating or loss of lubricant. Replace if any of these conditions are found.

REPAIRS

Dress minor imperfections with an oil stone. Reface severely marred journals.

If the journals exceed the wear limit, they should be refinished to size for the next undersize bearing.

Refinishing Journals. Refinish the journal to give the proper clearance with the next undersize bearing. If the journal will not "clean up" to give the proper clearance with the maximum undersize bearing available, replace the crankshaft.

Always reproduce the same journal shoulder radius that existed originally. Too small a radius will result in fatigue failure of the crankshaft. Too large a radius will result in bearing failure due to radius ride of the bearing.

After refinishing the journals, chamfer the oil holes, then polish the journal with a No. 320 grit polishing cloth and engine oil. Crocus cloth may be used also as a polishing agent.

CONNECTING RODS

The connecting rods and related parts should be carefully inspected and checked for conformance to specifications. Various forms of engine wear caused by these parts can be readily identified.

A shiny surface on the pin boss side of the piston usually indicates that a connecting rod is bent or the piston pin hole is not in proper relation to the piston skirt and ring grooves.

Abnormal connecting rod bearing wear can be caused by either a bent connecting rod, an improperly machined crankpin, or a tapered connecting rod bore.

Twisted connecting rods will not create an easily identifiable wear pattern, but badly twisted rods will disturb the action of the entire piston, rings, and connecting rod assembly and may be the cause of excessive oil consumption.

CLEANING

Remove the bearings from the rod and cap. Identify the bearings if they are to be used again. Clean the connecting rod in solvent, including the rod bore and the back of the inserts. **Do not use a caustic cleaning solution.** Blow out all passages with compressed air.

INSPECTION

Inspect the connecting rods for signs of fractures and the bearing bores for out-of-round and taper. If the bore exceeds the recommended limits and/or if the connecting rod is fractured, it should be replaced.

Check the piston pin to connecting rod bushing clearance. Replace the connecting rod if the bushing is so worn that it cannot be reamed or honed for an oversize pin.

Replace defective connecting rod nuts and bolts.

After the connecting rods are assembled to the piston, check the connecting rods for bend or twist on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. If the bend and/or twist is excessive, the connecting rod should be straightened or replaced.

PISTONS, PINS, AND RINGS

CLEANING

Remove deposits from the piston surfaces. Clean gum or varnish from the piston skirt, piston pins, and rings with solvent. **Do not use a caustic cleaning solution or a wire brush to clean pistons.** Clean the ring grooves with a ring groove cleaner (Fig. 23). Make sure the oil ring slots (or holes) are clean.

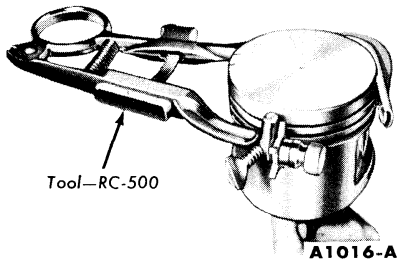

FIG. 23—Cleaning Ring Grooves

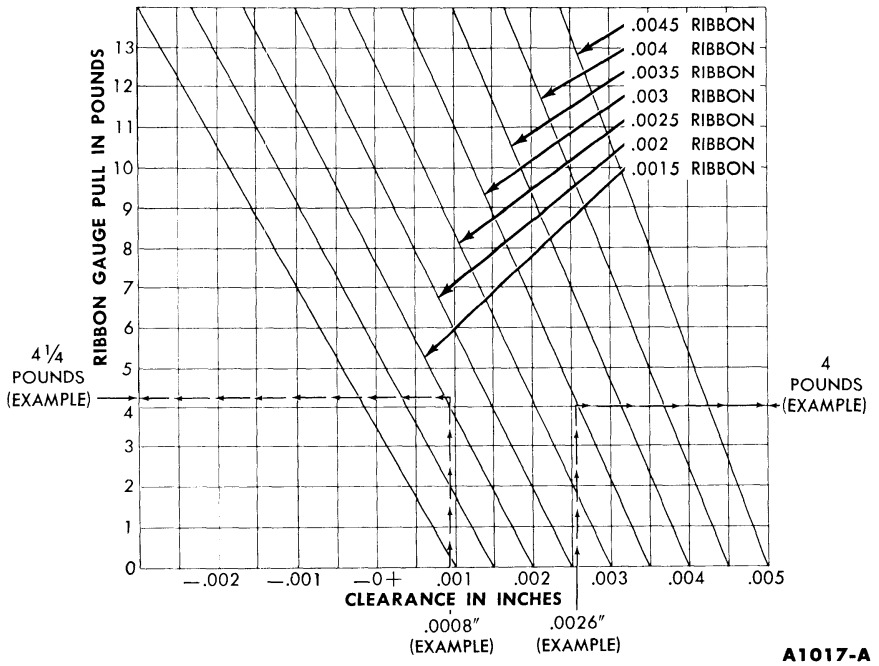

FIG. 24—Piston Clearance Chart

INSPECTION

Carefully inspect the pistons for fractures at the ring lands, skirts, and pin bosses, and for scuffed, rough, or scored skirts. If the lower inner portion of the ring grooves have high steps, replace the piston. The step will interfere with ring operation and cause excessive ring side clearance.

Spongy, eroded areas near the edge of the top of the piston are usually caused by detonation, or pre-ignition. A shiny surface on the thrust surface of the piston, offset from the centerline between the piston pin holes, can be caused by a bent connecting rod. Replace pistons that show signs of excessive wear, wavy ring lands, fractures, and/or damage from detonation or pre-ignition.

Check the piston to cylinder bore clearance with a tension scale and ribbon, following the procedure under "Fitting Pistons." Check the ring side clearance following the procedure under "Fitting Piston Rings."

Replace piston pins showing signs of fracture or etching and/or wear. Check the piston pin fit in the piston and rod.

Replace all rings that are scored, chipped, or cracked. Check the end gap and side clearance. It is good practice to always install new rings when overhauling the engine. **Rings should not be transferred from one piston to another regardless of mileage.**

REPAIRS

Fitting Pistons. Pistons are available for service in standard sizes and 0.020, 0.030, 0.040, and 0.060-inch oversize.

If the clearance is greater than the maximum limit, recheck calculations to be sure that the proper size piston has been selected, check for a damaged piston, then try a new piston.

If the clearance is less than the minimum limit, recheck calculations before trying another piston. If none can be fitted, refinish the cylinder for the next size piston.

When a piston has been fitted, mark it for assembly in the cylinder to which it was fitted.

If the taper and out-of-round conditions of the cylinder bore are within limits, new piston rings will give satisfactory service provided the piston clearance in the cylinder bore is within limits. If the new rings are to be installed in a used cylinder that has not been refinished, remove the cylinder wall "glaze."

To fit a piston:

1. Calculate the size piston to be used by taking a cylinder bore check (Fig. 30).

2. Select the proper size piston to provide the desired clearance.

3. Make sure the piston and cylinder block are at room temperature (70°F). **After any refinishing operation, allow the cylinder bore to cool and make sure the piston and bore are clean and dry before the piston fit is checked.**

4. Attach a tension scale to the end of a feeler gauge ribbon that is free of dents or burrs. The feeler ribbon should be ½-inch wide and of one of the thicknesses listed in Fig. 24.

5. Position the ribbon in the cylinder bore so that it extends the entire length of the piston at 90° from the piston pin location.

6. Invert the piston and install it in the bore so that the end of the piston is about 1½ inches below the top of the cylinder block and the piston pin is parallel to the crankshaft axis.

7. Hold the piston and slowly pull the scale in a straight line with the ribbon, noting the pull required to remove the feeler ribbon (Fig. 25).

In Fig. 24, the diagonal lines represent feeler ribbons of various thicknesses, the horizontal lines represent the pounds pull, and the vertical lines represent the clearances. To determine the clearance, locate the line representing the pounds pull required to remove the feeler ribbon from the cylinder bore. Follow the horizontal line to the right until it intersects the diagonal line representing the feeler ribbon. Read down the vertical line for the clearance.

Example 1. If a 0.0015-inch feeler ribbon is used and it takes approximately 4¼-pounds pull to remove the feeler ribbon, the clearance is approximately 0.0008 inch. This is determined by locating the pounds pull (4¼) in Fig. 24 and following the line to the right until it intersects with the diagonal line representing the 0.0015-inch feeler ribbon. Read down the vertical line for the clearance (approximately 0.0008 inch).

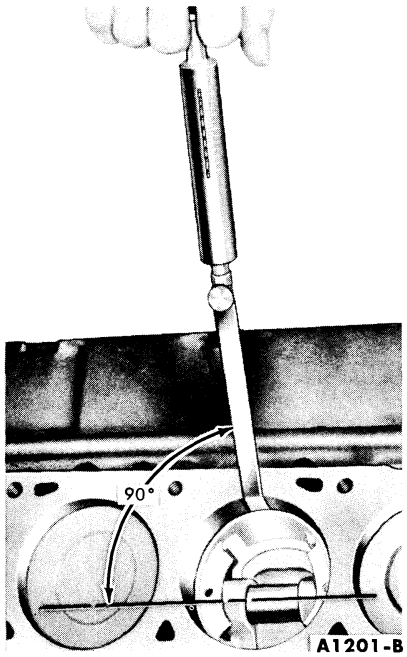

FIG. 25—Checking Piston Fit

Example 2. If a 0.003-inch feeler ribbon is used and it takes approximately 9-pounds pull to remove the ribbon, the resultant clearance is approximately 0.0015 inch.

FITTING PISTON RINGS

1. Select the proper ring set for the size piston to be used.
2. Position the ring in the cylinder bore in which it is going to be used.
3. Push the ring down into the bore area where normal ring wear is not encountered.
4. Use the head of a piston to position the ring in the bore so that the ring is square with the cylinder wall. **Use caution to avoid damage to the ring or cylinder bore.**
5. Measure the gap between the ends of the ring with a feeler gauge (Fig. 26). If the ring gap is less than the recommended lower limit, try another ring set.

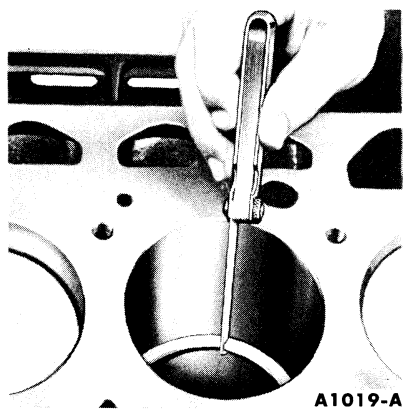

FIG. 26—Piston Ring Gap

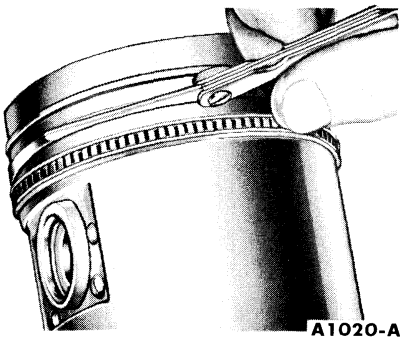

FIG. 27—Ring Side Clearance

6. Check the ring side clearance of the compression rings with a feeler gauge inserted between the ring and its lower land (Fig. 27). The gauge should slide freely around the entire ring circumference without binding. Any wear that occurs will form a step at the inner portion of the lower land. **If the lower lands have high steps, the piston should be replaced.**

Fitting Piston Pins. The piston pin should be a light thumb press fit at normal temperature (70°F). Standard piston pins are color coded green. Pins of 0.001-inch oversize (color coded blue) and 0.002-inch oversize (color coded yellow) are available.

If the pin hole in the piston must be reamed, use an expansion-type piloted reamer. Place the reamer in a vise and revolve the piston around the reamer. Set the reamer to the size of the pin bore, then expand the reamer slightly and trial ream the pin bore. Take a light cut. Use a pilot sleeve of the nearest size to maintain alignment of the bores.

Check the hole size, using the new piston pin. If the bore is small, expand the reamer slightly and make another cut. Repeat the procedure until the proper fit is obtained. Check the piston pin for fit in the respective rod bushing. If necessary, ream or hone the bushing to fit the pin.

Install the piston pin in the piston and rod. Install a new retainer at each end of the pin to hold it in place. Spiral the retainers into position with the fingers. Do not use pliers. Make sure the retainers are properly seated in their grooves.

MAIN AND CONNECTING ROD BEARINGS

CLEANING AND INSPECTION

Clean the bearing inserts and caps thoroughly. Inspect each bearing carefully. Bearings that have a scored, chipped, or worn surface should be replaced. Typical examples of bearing failures and their causes are shown in Fig. 28. The copper lead bearing base may be visible through the bearing overlay. This does not mean that the bearing is worn. Do not replace the bearing if the bearing clearance is within recommended limits. Check the clearance of bearings that appear to be satisfactory with Plastigage. Fit new bearings following the recommended procedure (Part 1-2, 1-3, or 1-4).

FLYWHEEL—MANUAL-SHIFT TRANSMISSIONS

INSPECTION

Inspect the flywheel for cracks, heat check, or other defects that would make it unfit for further service. Machine the friction surface of the flywheel if it is scored or worn. If it is necessary to remove more

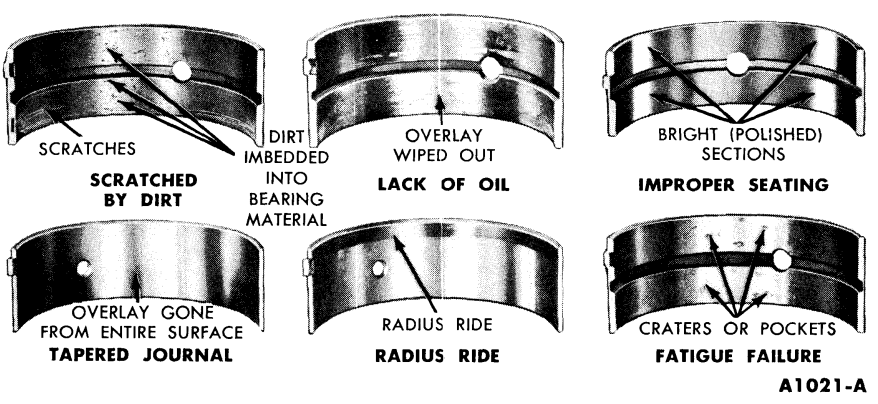

FIG. 28—Bearing Failures

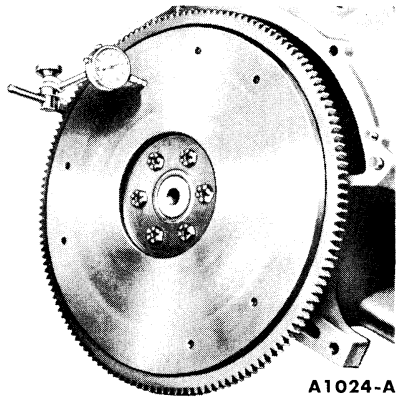
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FIG. 29—Flywheel Face Runout

than 0.045 inch of stock from the original thickness, replace the flywheel.

Inspect the ring gear for worn, chipped, or cracked teeth. If the teeth are damaged, replace the ring gear.

With the flywheel installed on the crankshaft, check the flywheel face runout.

FLYWHEEL FACE RUNOUT

Install a dial indicator so that the indicator point bears against the flywheel face (Fig. 29). Turn the flywheel making sure that it is full forward or rearward so that crankshaft end play will not be indicated as flywheel runout.

RING GEAR REPLACEMENT

Heat the defective ring gear with a blow torch on the engine side of the gear, then knock it off the flywheel. **Do not hit the flywheel when removing the ring gear.**

Heat the new ring gear evenly until the gear expands enough to slip onto the flywheel. Make sure the gear is seated properly against the shoulder. **Do not heat any portion of the gear to a temperature higher than 500°F. If this limit is exceeded, the temper will be removed from the ring gear teeth.**

CYLINDER BLOCK

CLEANING

Thoroughly clean the block in solvent. Remove old gasket material from all machined surfaces. Remove all pipe plugs which seal oil passages, then clean out all the passages. Blow out all passages, bolt holes, etc. with compressed air. Make sure the threads in the cylinder head bolt holes are clean. Dirt in the threads may cause binding and result in a false torque reading. Use a tap to true-up threads and to remove any deposits.

INSPECTION

After the block has been thoroughly cleaned, make a check for cracks. Minute cracks not visible to the naked eye may be detected by coating the suspected area with a mixture of 25% kerosene and 75% light motor oil. Wipe the part dry and immediately apply a coating of zinc oxide dissolved in wood alcohol. If cracks are present, the coating will become discolored at the defective area. Replace the block if it is cracked.

Check all machined gasket surfaces for burrs, nicks, scratches, and scores. Remove minor imperfections with an oil stone. Check the flatness of the cylinder block gasket surface following the procedure and specifications recommended for the cylinder head.

Replace all expansion-type plugs that show evidence of leakage.

Inspect the cylinder walls for scoring, roughness, or other signs of wear. Check the cylinder bore for out-of-round and taper. Measure the bore with an accurate gauge following the instructions of the manufacturer. Measure the diameter of each cylinder bore at the top, middle, and bottom with the gauge placed at right angles and parallel to the centerline of the engine (Fig. 30).

Refinish cylinders that are deeply scored and/or when out-of-round

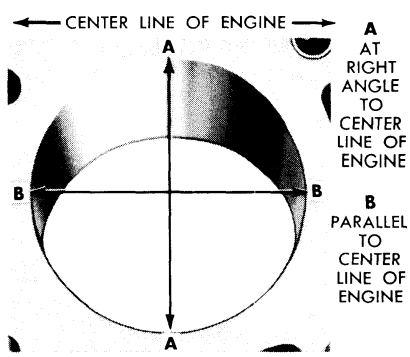
CENTER LINE OF ENGINE
A
A
AT RIGHT ANGLE TO CENTER LINE OF ENGINE
B
B
B
PARALLEL TO CENTER LINE OF ENGINE
A
1. OUT-OF-ROUND = DIFFERENCE BETWEEN A AND B
2. TAPER = DIFFERENCE BETWEEN THE A MEASUREMENT AT TOP OF CYLINDER BORE AND THE A MEASUREMENT AT BOTTOM OF CYLINDER BORE
A1025-A

FIG. 30—Cylinder Bore Out-of-Round and Taper

and/or taper exceed the wear limits.

If the cylinder walls have minor surface imperfections, but the out-of-round and taper are within limits, it may be possible to remove the imperfections by honing the cylinder walls and installing new service piston rings providing the piston clearance is within limits. Use the finest grade of honing stone for this operation.

REPAIRS

Refinishing Cylinder Walls. Honing is recommended for refinishing cylinder walls only when the walls have minor imperfections, such as light scuffs, scratches, etc. The grade of hone to be used is determined by the amount of metal to be removed. Follow the instructions of the hone manufacturer. If coarse stones are used to start the honing operation, leave enough material so that all hone marks can be removed with the finishing hone which is used to obtain the proper piston clearance.

Cylinder walls that are severely marred and/or worn beyond the specified limits should be refinished. Before any cylinder is refinished, all main bearing caps must be in place and tightened to the proper torque so that the crankshaft bearing bores will not become distorted from the refinishing operation.

Refinish only the cylinder or cylinders that require it. **All pistons are the same weight, both standard and oversize; therefore, various sized pistons can be intermixed without upsetting engine balance.**

Refinish the cylinder with the most wear first to determine the maximum oversize. If the cylinder will not clean up when refinished for the maximum oversize piston recommended, replace the block.

Refinish the cylinder to within approximately 0.0015 inch of the required oversize diameter. This will allow enough stock for the final step of honing so that the correct surface finish and pattern are obtained. Use clean sharp hones of No. 220-280 grit for this operation.

For the proper use of the refinishing equipment, follow the instructions of the manufacturer. Only experienced personnel should be allowed to perform this work.

After the final operation in either of the two refinishing methods described and prior to checking the

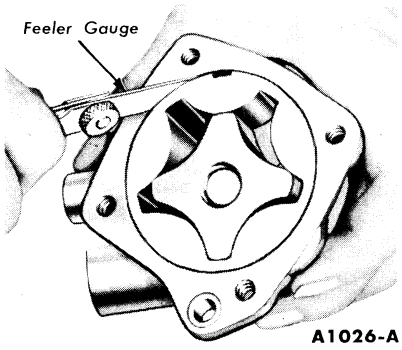

FIG. 31—Outer Race to Housing Clearance

piston fit, thoroughly wash the cylinder walls with solvent to remove all abrasive particles, then thoroughly dry the walls. Check the piston fit. Mark the pistons to correspond to the cylinders in which they are to be installed. When the refinishing of all cylinders that require it has been completed and all pistons fitted, thoroughly clean the entire block to remove all particles from the bearing bores, oil passages, cylinder head bolt holes, etc. Coat the cylinder walls with oil.

OIL PAN AND OIL PUMPS

OIL PAN

Scrape any dirt or metal particles from the inside of the pan. Scrape all old gasket material from the gasket surface. Wash the pan in a solvent and dry it thoroughly. Be sure all foreign matter is removed from below the baffle plate.

Check the pan for cracks, holes, damaged drain plug threads, a loose baffle, and a nicked or damaged gasket surface.

Repair any damage, or replace the pan if repairs cannot be made.

OIL PUMPS

Cleaning. Wash all parts in a solvent and dry them thoroughly. Use a brush to clean the inside of the pump housing and the pressure relief valve chamber. Be sure all dirt and chips are removed.

Inspection. Check the inside of the pump housing and the outer race and rotor for damage or excessive wear.

Check the mating surface of the pump cover for wear. If the cover mating surface is worn, scored, or grooved, replace the cover.

Measure the outer race to housing clearance (Fig. 31).

With the rotor assembly installed in the housing, place a straight edge over the rotor assembly and the housing. Measure the clearance between the straight edge and the rotor and outer race (Fig. 32).

The outer race, shaft and rotor are replaceable only as an assembly.

Check the drive shaft to housing bearing clearance by measuring the OD of the shaft and the ID of the housing bearing.

Inspect the relief valve spring for a collapsed or worn condition.

Check the relief valve spring tension. If the spring tension is not within specifications and/or the spring is defective, replace the spring.

Check the relief valve piston for scores and free operation in the bore.

CRANKCASE VENTILATION SYSTEM MAINTENANCE

Refer to Group 14 for the correct mileage interval for maintenance.

BREATHER CAP

The breather cap located on the oil filler tube should be cleaned with a solvent at the proper mileage interval.

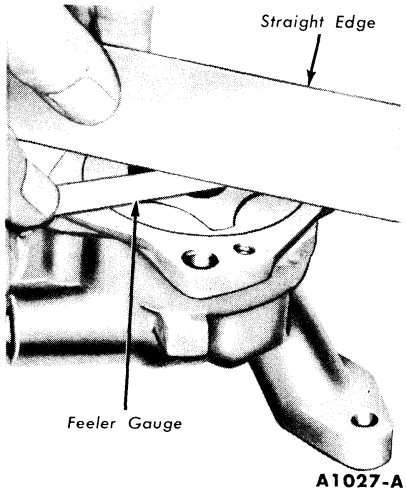

FIG. 32—Rotor End Play

POSITIVE CRANKCASE VENTILATION SYSTEM

At the recommended interval, remove the crankcase ventilation regulator valve, intake manifold fitting, exhaust tube, connections, and outlet adapter. Clean the valve, exhaust tube, intake manifold fitting, and outlet adapter in clean carburetor solvent and dry them with compressed air. Clean the rubber hose connections with a low volatility petroleum base solvent and dry them with compressed air.

VENT TUBE-TYPE CRANKCASE VENTILATION SYSTEM

The road draft tube seldom requires cleaning except during a high mileage engine overhaul. However, if there is evidence of crankcase pressure, the tube should be checked for excessive sludge and cleaned out if necessary. In addition, on the 352 and 390 V-8 engines, the maze screen in the intake manifold baffle plate should be cleaned in solvent to remove any accumulation of sludge deposits.

PART 1-2 MILEAGE MAKER SIX

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1 DESCRIPTION

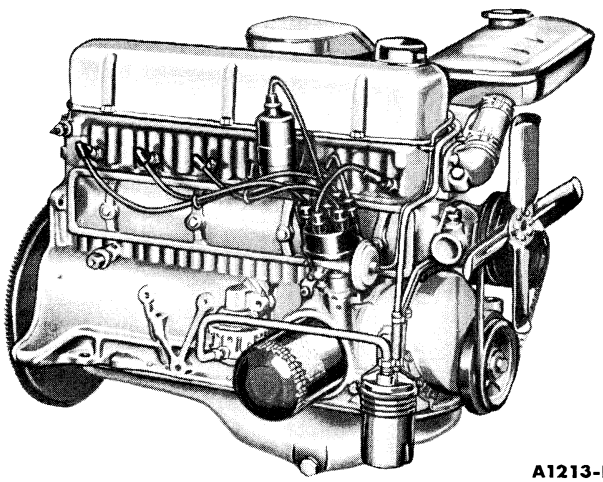

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FIG. 1—Mileage Maker Six

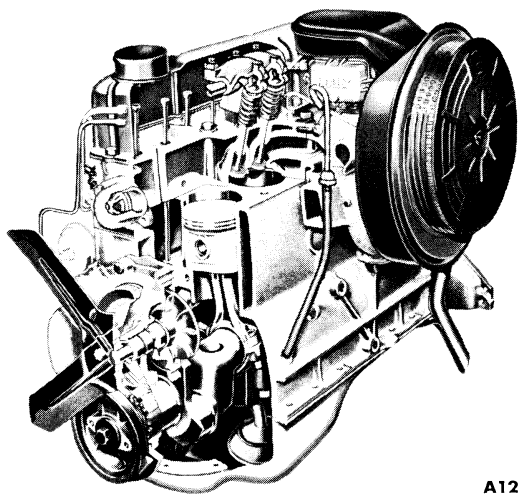

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FIG. 2—Mileage Maker Six—Sectional

The Mileage Maker Six (Figs. 1 and 2) has a piston displacement of 223 cubic inches. The engine is available in all car models. The patent plate identification symbol is "V."

MANIFOLDS

A chamber (heat riser) is cast into the intake manifold center section between the carburetor and exhaust manifold. A thermostatically controlled valve, located in the exhaust manifold (Fig. 3), directs exhaust gases into this area to provide the heat necessary to assist in vaporizing the incoming fuel mixture.

CYLINDER HEAD

The cylinder head carries the valves, valve rocker arm shaft assembly, manifold assembly, ignition coil, the coolant outlet, and thermostat. Valve guides are cast integral in the head. The valves are arranged from front to rear E-I-I-E-I-E-E-I-E-I-I-E.

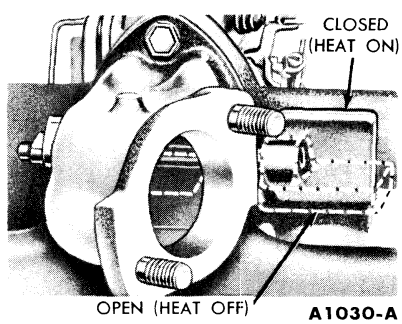

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FIG. 3—Exhaust Gas Control Valve

CYLINDER BLOCK

The cylinders are numbered from 1-6 starting at the front of the engine. The firing order is 1-5-3-6-2-4.

The distributor, located at the right front of the engine, drives the oil pump through an intermediate drive shaft.

The crankshaft is supported by four main bearings. Crankshaft end thrust is controlled by the flanges of the No. 3 main bearing.

The pistons have two compression rings and one oil control ring. The top compression ring is chrome-plated and the lower compression ring is phosphate - coated. The oil control ring assembly consists of a serrated spring and two chrome-plated steel rails.

VALVE TRAIN

The intake and exhaust valve assemblies are the rotating-type. The tappets are the solid steel, mushroom-type.

The camshaft is supported by four bearings pressed into the block. It is driven by a sprocket and timing chain in mesh with a sprocket on the crankshaft. Camshaft thrust is controlled by a thrust plate located between the timing chain snubber pad and the front journal of the camshaft. An eccentric, made integral with the camshaft, operates the fuel pump.

Silent lash rocker arms are used which mechanically provide zero valve lash and minimize valve train noise and wear. The operation and parts identification of the silent lash rocker arms are shown in Fig. 4.

When the valve is closed, the tappet is on the base circle of the camshaft lobe and the valve push rod is in its lowest position. With the rocker arm in this position, the eccentric actuating spring expands forcing the plunger outward against the valve and takes up any clearance that may be present (Fig. 4).

As the camshaft rotates and the valve begins to open, the valve push rod is forced up against the rocker arm which in turn pushes the eccentric down on the valve. This action moves the eccentric inward, slightly and compresses the spring and plunger (Fig. 4). As the high point on the camshaft lobe rotates past the tappet, the push rod is lowered and the valve spring closes the valve. The eccentric actuating spring expands and pushes the plunger against the eccentric. The eccentric then moves outward against the valve to take up any clearance that tends to be present.

The rocker arm eccentric functions throughout the rocker arm motion during the valve opening and closing cycle, compensating for expansion or wear of the valve train. Therefore, solid contact (zero lash) between all parts of the valve train mechanism is maintained.

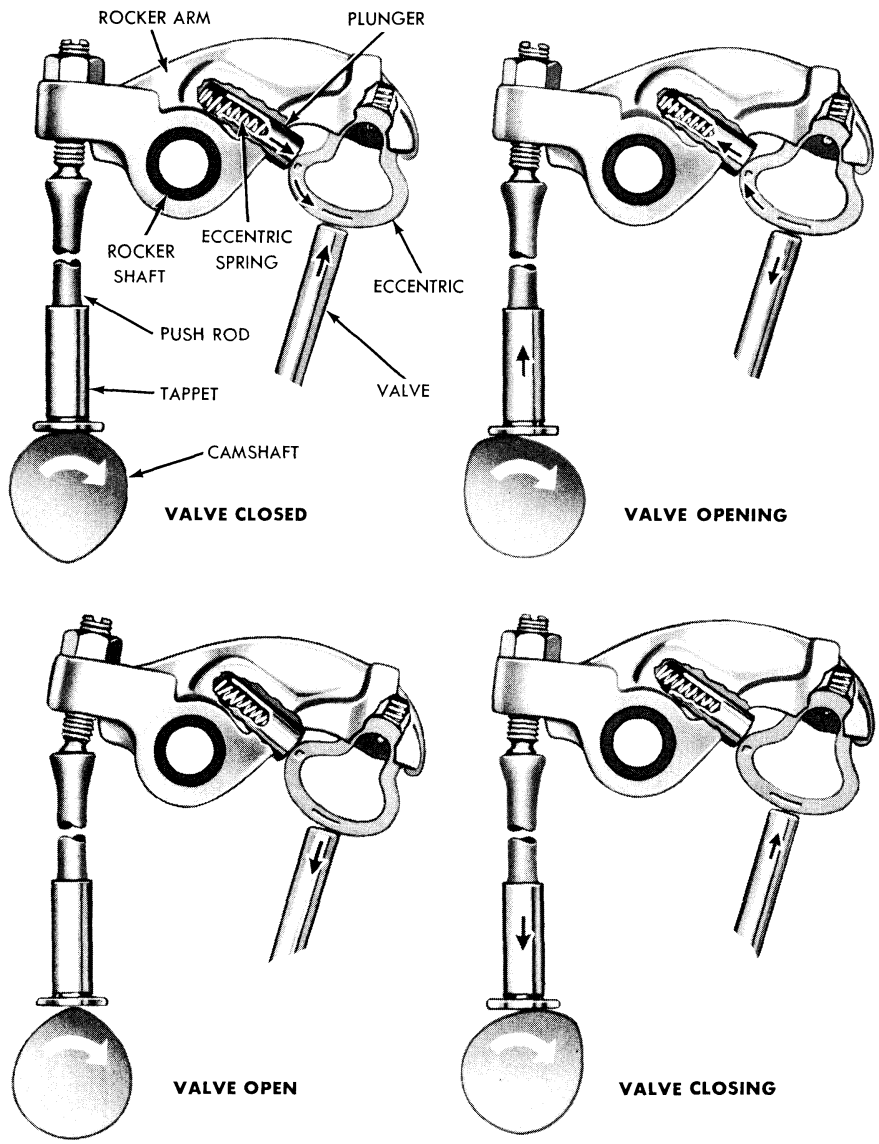

FIG. 4—Silent Lash Rocker Arm Operation

LUBRICATION SYSTEM

Oil from the oil pan sump is forced through the pressure-type lubrication system (Fig. 5) by a rotor-type oil pump. A spring-loaded relief valve in the pump limits the maximum pressure of the system. Oil relieved by the valve is directed back to the intake side of the pump.

The engine has a full-flow filter which filters the entire output of the pump before the oil enters the engine. The filter has an integral relief valve and mounting gasket. The relief valve permits oil to by-pass the filter if it becomes clogged, thereby maintaining an emergency supply of oil to the engine at all times. An anti-drain back diaphragm prevents a reverse flow of oil when the engine is stopped.

From the filter, the oil flows into the main oil gallery. The oil gallery supplies oil to all the camshaft and main bearings through a drilled passage in each main bearing web.

The timing chain and sprockets are lubricated through a flat on the No. 1 camshaft bearing.

Oil slingers prevent leakage by directing oil away from the crankshaft front and rear oil seals.

Cylinder walls, pistons, and piston pins are lubricated through a drilled hole in each connecting rod which indexes with a drilled hole in the connecting rod journal of the crankshaft.

Oil under reduced pressure lubricates the valve rocker arm shaft assembly. The oil is fed through a drilled passage in the cylinder block at the No. 3 camshaft bearing. The oil is metered by a groove in the bearing. The passage in the block indexes with a hole in the cylinder head. An oil inlet tube directs the oil into the hollow rocker shaft through

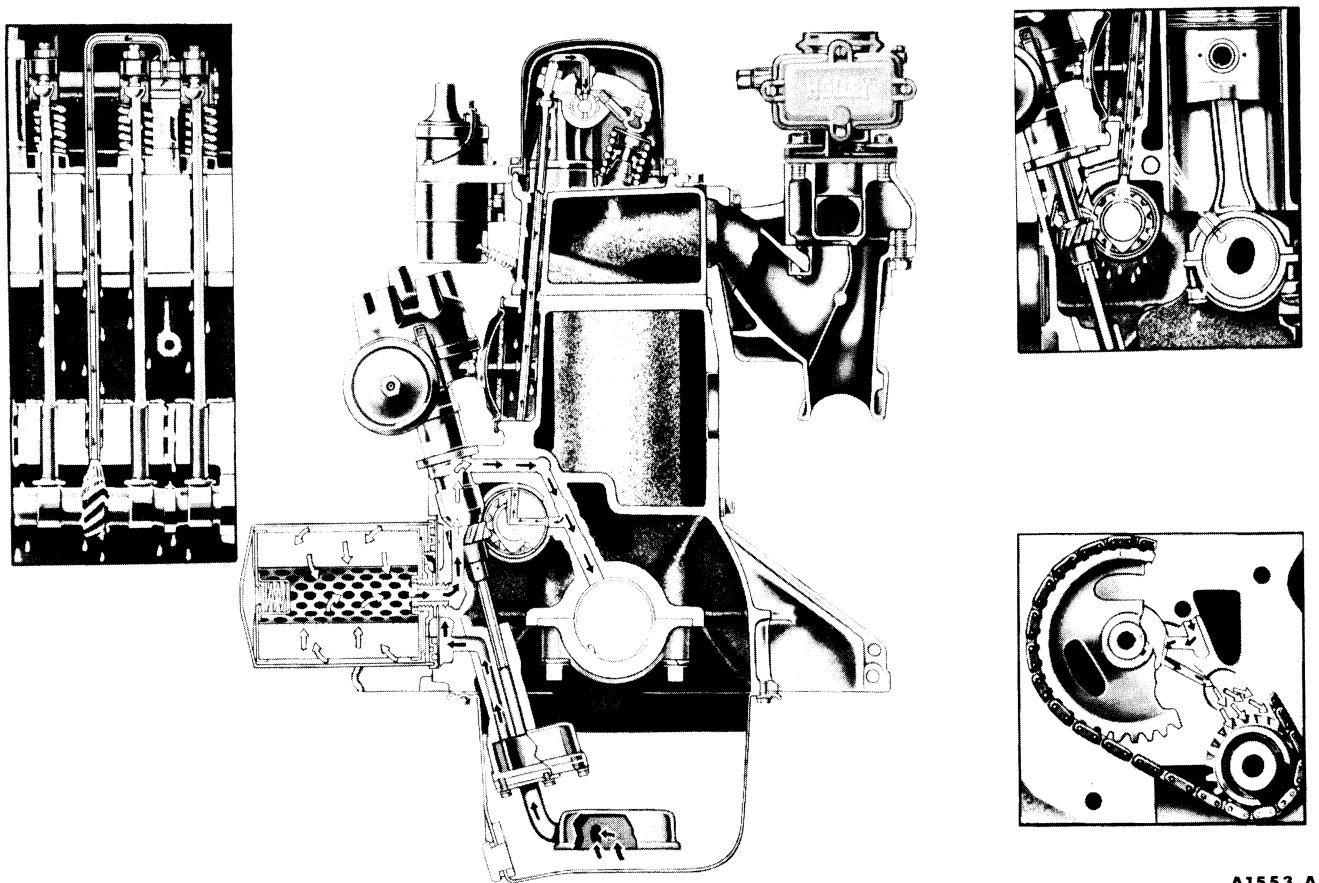

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FIG. 5—Lubrication System

the No. 4 valve rocker arm support. The oil from the shaft flows through drilled holes in each rocker arm to lubricate the eccentric, rocker arm shaft bore, the valve, and ball end of the rocker arm. Excess oil spirals down the rotating push rod and assists in lubricating the tappet and push rod seat. An oil outlet tube exhausts excess oil from the rocker shaft to lubricate the distributor lower bushing and distributor drive gear. The oil outlet tube is located at the No. 1 rocker arm support. The oil from each rocker arm drains into the push rod chamber through holes provided in the cylinder head.

The oil in the push rod chamber drains back into the oil pan through an opening at the back of the block.

CRANKCASE VENTILATION

The Mileage Maker Six engine is equipped with either a vent tube-type crankcase ventilation system or a positive crankcase ventilation system.

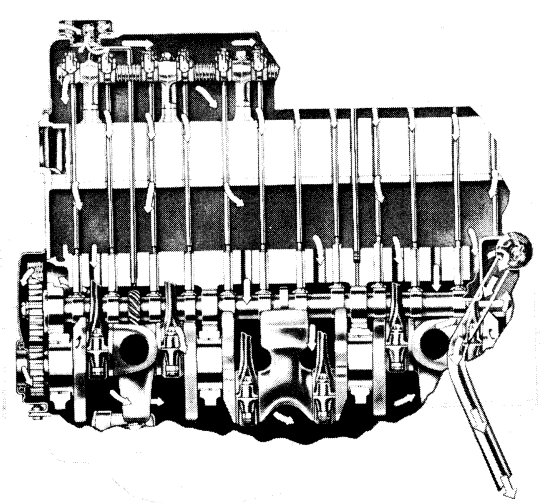

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FIG. 6—Vent Tube-Type Crankcase Ventilation System

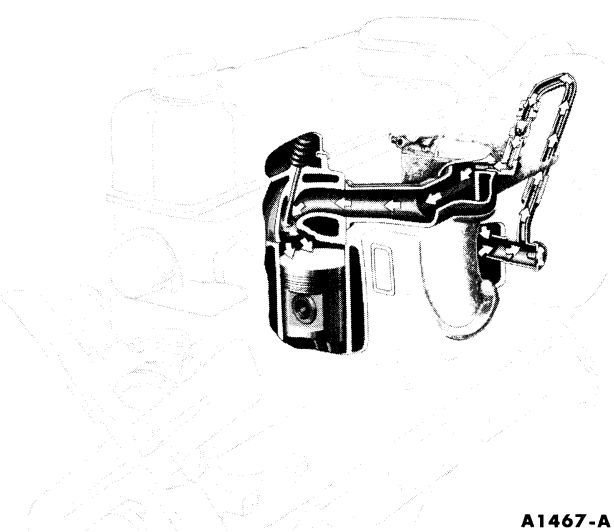

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FIG. 7—Positive Crankcase Ventilation System

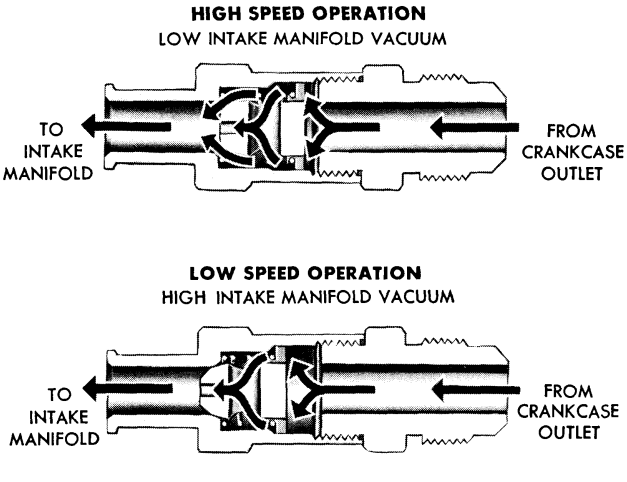

FIG. 8—Positive Crankcase Ventilation Regulator Valve

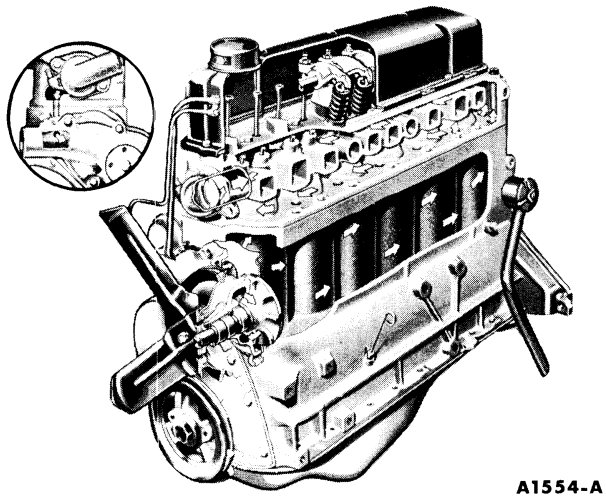

FIG. 9—Cooling System

In the vent tube-type system, the crankcase vapors are discharged to the atmosphere. In the positive system, the crankcase vapors are directed to the intake manifold.

VENT TUBE-TYPE CRANKCASE VENTILATION SYSTEM

A crankcase ventilation tube is located at the rear of the engine. The forward motion of the car causes a partial vacuum to be formed at the tube outlet. This vacuum action causes air to be drawn through the engine from the combination oil filler and breather cap located in the front of the valve push rod chamber cover (Fig. 6). The filler cap contains a maze filtering element.

Filtered air from the breather cap flows into the front section of the valve rocker arm shaft chamber. Here the air has a chance to normalize its temperature before contacting contaminating vapors originating in the crankcase. Warm ventilating air minimizes the formation of crankcase sludge.

The ventilating air moves down past the push rods into the crankcase. Air is diverted from the front section of the crankcase through holes in the front of the cylinder block wall to ventilate the timing chain chamber. The air from the crankcase is then directed into the crankcase ventilation tube by the rotating action of the crankshaft.

POSITIVE CRANKCASE VENTILATION SYSTEM

Ventilating air enters the engine in the normal manner through the breather cap and is distributed through the engine in the same manner as in the vent tube-type system. However, instead of the ventilating air being discharged to the atmosphere, it is directed to the intake manifold. The air is directed to the intake manifold through an exhaust tube which extends from the crankcase ventilation outlet in the left side of the cylinder block to a spring-loaded regulator valve (Fig. 7). The valve regulates the amount of air to meet changing operating conditions.

During idle, intake manifold vacuum is high. The high vacuum overcomes the tension of the spring pressure and seats the valve (Fig. 8). With the valve in this position, all the ventilating air passes through a calibrated orifice in the valve. With the valve seated, there is minimum ventilation. As engine speed increases and manifold vacuum decreases, the spring forces the valve off its seat and to the full open position. This increases the flow of ventilating air.

COOLING SYSTEM

The coolant is drawn from the bottom of the radiator by the water pump which delivers the coolant to the cylinder block (Fig. 9).

As the coolant enters the block, it travels through cored passages to cool the entire length of each cylinder wall. Upon reaching the rear of the cylinder block, the coolant is directed upward into the cylinder head where it cools the combustion chambers, valves, and valve seats on its return to the front of the engine.

The coolant from the cylinder head flows past the thermostat if it is open, into the radiator supply tank. If the thermostat is closed, a small portion of the coolant is returned to the water pump for recirculation. The entire system is pressurized to 13-15 psi.

2 ENGINE REMOVAL AND INSTALLATION

The engine removal and installation procedures are for the engine only without the transmission attached. The engine installation is shown in Fig. 10.

REMOVAL

1. Drain the cooling system and the crankcase. Remove the hood.

2. Disconnect the battery ground cable at the battery, the heater hose at the water pump and coolant outlet housing, and flexible fuel line at the fuel tank line.

3. Disconnect the radiator upper hose at the radiator supply tank. Dis-

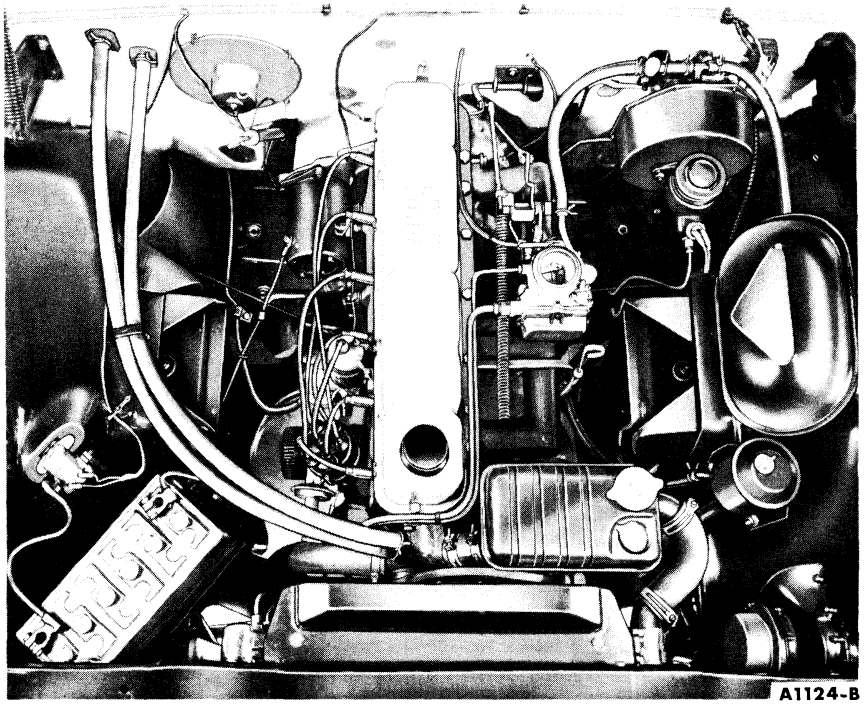

FIG. 10—Engine Installation

connect the radiator lower hose at the water pump.

On a car with an automatic transmission, disconnect the transmission oil cooler lines at the radiator.

4. Remove the radiator. Remove the air cleaner.

5. Disconnect the accelerator retracting spring and the accelerator rod assembly at the carburetor. Disconnect the choke control cable at the carburetor.

On a car with an automatic transmission, remove the accelerator bracket from the intake manifold, then tie the bracket to the dash panel.

6. Disconnect the exhaust manifold from the muffler inlet pipe. Disconnect the generator wires at the generator, and the engine ground strap at the converter housing or flywheel housing.

7. Disconnect the primary wire at the coil, the oil pressure and temperature sending unit wires at the sending units, and the starter cable at the starter.

8. Remove the starter (and the automatic transmission fluid filler tube bracket). Remove the engine rear plate upper right bolt.

On a car with a manual-shift transmission, remove the flywheel inspection cover. Disconnect the clutch release spring and rod. Remove the clutch bracket from the rear of the engine block.

On a car with an automatic transmission, remove the converter housing access cover and cover assembly. Remove the flywheel to converter nuts, then secure the converter assembly in the housing. Remove the transmission oil cooler lines from the retaining clip at the engine and remove the clip from the engine right mount.

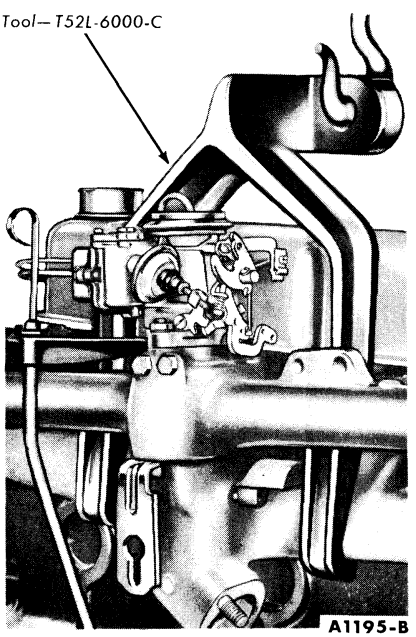

FIG. 11—Engine Lifting Hook

9. Remove the flywheel or converter housing to engine bolts. Support the transmission with a jack. Remove the remaining engine rear plate retaining bolts.

10. Remove the engine right and left support insulator to frame retaining nut.

11. Attach the engine lifting hook (Fig. 11). Raise the engine slightly, then carefully pull it from the transmission. Lift the engine out of the chassis, then install it on a work stand (Fig. 12).

INSTALLATION

1. Place a new gasket over the exhaust manifold to muffler inlet pipe studs.

2. Lower the engine carefully into the chassis. Make sure the studs on the exhaust manifold are aligned with the holes in the muffler inlet pipe and the dowels in the block engage the holes in the flywheel or converter housing.

On a car with an automatic transmission, start the converter pilot into the crankshaft. Remove the retainer securing the converter in the housing.

On a car with a manual-shift transmission, start the transmission main drive gear into the clutch disc. It may be necessary to adjust the position of the transmission with relation to the engine if the transmission input shaft will not enter the clutch disc. **If the engine "hangs up" after the shaft enters, turn the crankshaft slowly (with the transmission in gear) until the shaft splines mesh with the clutch disc splines.** Install the flywheel housing bolts and torque them to specifications. Remove the jack supporting the transmission

3. Install the converter or flywheel housing upper retaining bolts. Remove the engine lifting hook.

4. Install the engine left and right

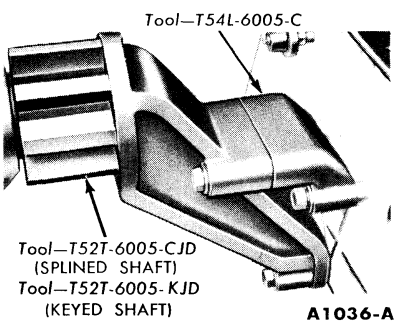

FIG. 12—Engine Mount

support insulator to engine retaining nuts (install the automatic transmission oil cooler lines bracket).

5. Install the remaining converter or flywheel housing retaining bolts. Install the engine rear plate lower retaining bolts.

6. Install the starter (and automatic transmission fluid filler tube bracket).

On a car with an automatic transmission, install the transmission oil cooler lines in the bracket at the engine block.

7. Install the exhaust manifold to muffler inlet pipe lock washers and nuts. Torque the nuts to specifications. Connect the engine ground strap, the generator wires, and the choke control cable.

On a car with an automatic transmission, install the accelerator bracket on the intake manifold.

On a car with a manual-shift transmission, connect the clutch release spring and rod. Adjust the clutch pedal free travel. Install the flywheel housing inspection cover.

8. Connect the accelerator retracting spring and the accelerator rod assembly.

9. Connect the starter cable, the coil primary wire, the oil pressure and temperature sending unit wires, flexible fuel line, the heater hoses, and the battery ground cable.

10. Install the radiator. Connect the radiator lower hose to the water pump and the radiator upper hose to the radiator supply tank.

On a car with an automatic transmission, connect the oil cooler lines.

11. Fill and bleed the cooling system. Fill the crankcase. Operate the engine at fast idle and check all hose connections and gaskets for leaks.

On a car with an automatic transmission, adjust the transmission control linkage.

12. Install the air cleaner. Install and adjust the hood.

3 IN-CHASSIS REPAIR OPERATIONS

ENGINE SUPPORTS

The front supports are located on each side of the cylinder block (Fig. 13). The rear support is located at the transmission extension housing (Fig. 14).

ENGINE FRONT SUPPORT

The procedures given apply to either a right or left installation.

Removal

1. Remove the support insulator assembly to frame nut and lock washer.

2. Raise the engine with a jack and a wood block placed under the oil pan.

3. Remove the support insulator assembly to support bracket bolts and lock washers. Remove the support insulator assembly. If only one support is removed, loosen the other support.

Installation

1. Position the support insulator assembly.

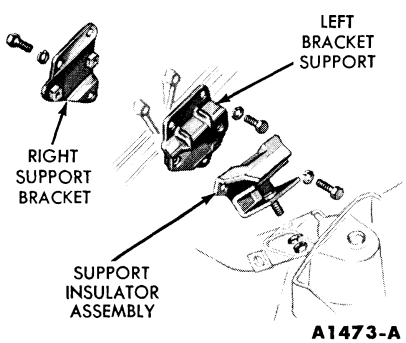

FIG. 13—Engine Front Support

2. Lower the engine. Install the support insulator assembly to frame lock washer and nut. Torque the nut to specifications.

3. Install the support insulator assembly to support bracket lock washers and bolts. Torque the bolts to specifications.

4. If only one support was removed, tighten the other support.

ENGINE REAR SUPPORT

Removal

1. Remove the support insulator assembly retaining bolts and washers.

2. Raise the engine slightly to gain clearance at the transmission. Remove the support insulator assembly.

Installation

1. Position the support insulator assembly. Lower the engine.

2. Install the support insulator assembly to extension housing flat washers, lock washers, and bolts. Torque the bolts to specifications.

MANIFOLDS

REMOVAL

1. Remove the air cleaner.

On a car with an automatic transmission, disconnect the throttle control rod and the accelerating assembly connecting link at the accelerator bracket. Disconnect the accelerator retracting spring at the block mounted bracket. Remove the bracket.

On a car with a manual-shift transmission, disconnect the accelerator retracting spring and the accelerator rod assembly at the bellcrank.

On an engine with positive crankcase ventilation, remove the exhaust tube and regulator valve as an assembly by disconnecting the bracket from the intake manifold, the exhaust tube from crankcase ventilation outlet and the regulator valve from the rubber connection (Fig. 16).

2. Disconnect the choke control cable at the carburetor.

3. Disconnect the fuel inlet line and the distributor vacuum line at the carburetor.

4. Disconnect the muffler inlet pipe from the exhaust manifold.

5. Remove the bolts fastening the manifolds to the head (two manifold

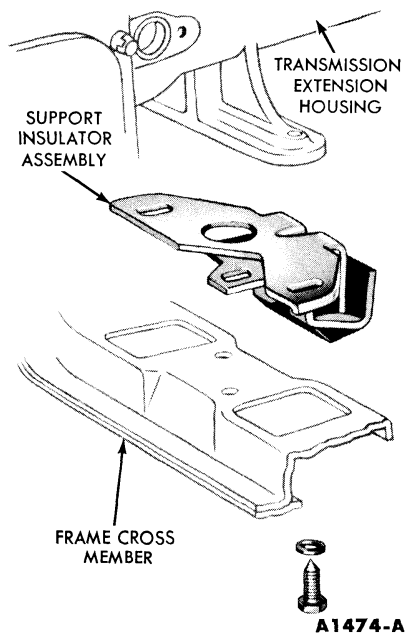

FIG. 14—Engine Rear Support

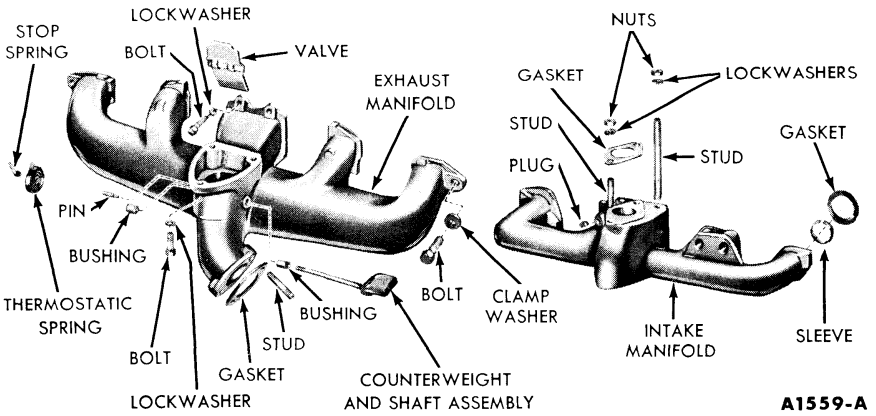

FIG. 15—Manifold Assemblies

bolts retain the radiator supply tank mounting bracket and one bolt retains the oil level dipstick tube bracket). Lift the manifold assemblies from the head. Remove the gaskets and sleeves.

6. To separate the manifolds, remove the air cleaner bracket and remove the nuts and bolt joining the intake and exhaust manifolds.

INSTALLATION

The manifold assemblies are shown in Fig. 15.

1. Clean the gasket surfaces at the cylinder head and manifolds.

2. If the intake and exhaust manifolds have been separated, place the intake manifold over the studs on the exhaust manifold. Position the air cleaner bracket to the exhaust manifold. Install the lock washers, nuts and bolt, then tighten them finger-tight.

3. Install new intake manifold gaskets using new sleeves, if necessary, in the ports of the cylinder head.

4. Place a new exhaust manifold to muffler inlet pipe gasket over the studs on the exhaust manifold.

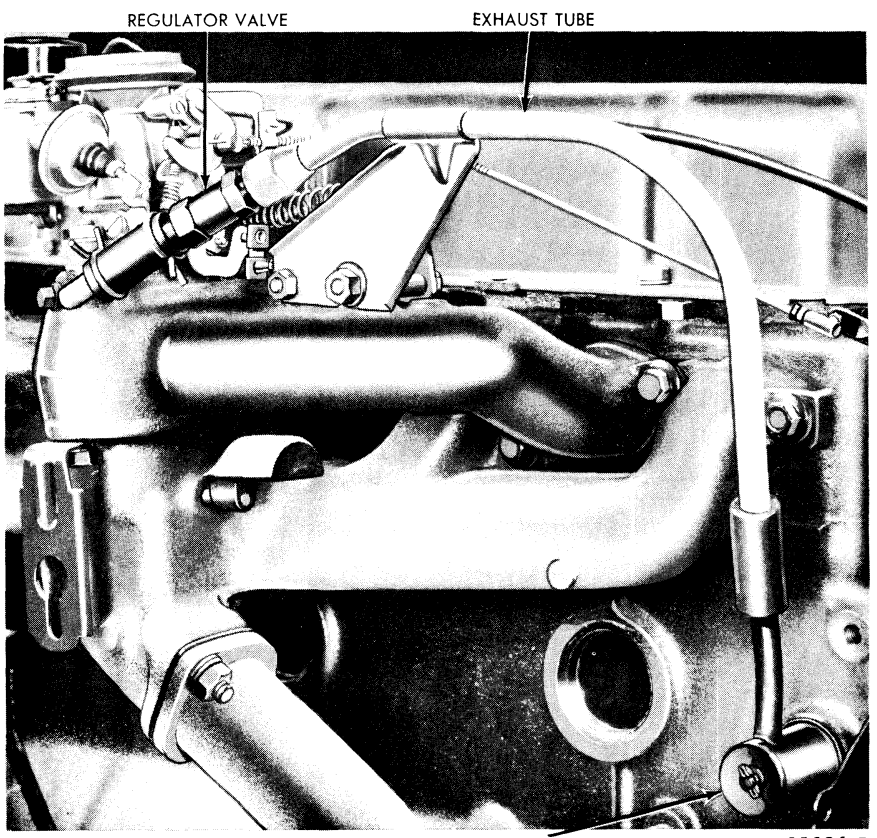

FIG. 16—Regulator Valve and Exhaust Tube

5. Coat the mating surfaces lightly with graphite grease. Place the manifold assemblies in position against the head. **Make sure that none of the gaskets have become dislodged.** Position the radiator supply tank bracket and oil level dipstick tube bracket. Install the attaching washers and bolts. Torque the bolts to specifications, tightening from the center to the ends.

If the intake and exhaust manifolds were separated, tighten the bolt and nut joining them.

6. Install the exhaust manifold to muffler inlet pipe lock washers and nuts. Torque the nuts to specifications.

On an engine with positive crankcase ventilation, install the exhaust tube and regulator valve.

7. Connect the choke control cable. Connect the fuel inlet line and the distributor vacuum line at the carburetor.

On a car with an automatic transmission, install the accelerator retracting spring bracket. Connect the spring. Connect the accelerator assembly connecting link and adjust the transmission control linkage.

On a car with a manual-shift transmission, connect the accelerator retracting spring and the accelerator rod assembly.

8. Install the air cleaner. Adjust the engine idle speed and idle fuel mixture.

EXHAUST GAS CONTROL VALVE REPLACEMENT

The exhaust gas control valve (Fig. 3) is located in the outlet of the exhaust manifold. Normally, it does not require replacement unless it becomes inoperative due to excessive corrosion or damage.

1. Remove the manifold assemblies and separate the intake and exhaust manifolds following the procedures under "Manifold Removal."

2. Before removing the control valve assembly, note the position of the counterweight in relation to the valve plate. Remove the stop spring and thermostatic spring from the front end of the shaft.

3. Using an acetylene torch inside the manifold, cut the shaft on both sides of the valve plate. **Use caution to avoid damage to the shaft bearing bores.**

4. Remove the valve and shaft.

5. Clean the bushings of corrosion and repair any damage that may have occurred. Replace the bushings if necessary.

When new bushings are installed, there should be a distance of 2⅜ inches from the inside edge of one bushing to the inside edge of the other bushing. The bushings should be equally spaced within the counterbores.

6. After installation, ream the bushings with a 5/16-inch reamer.

7. Lubricate the new shaft and bushings with FoMoCo Exhaust Control Valve Solvent (COAA-19A501-A) or a penetrating oil and graphite mixture.

8. Insert the shaft through the bushings and valve plate.

9. Rotate the shaft in the valve plate until the counterweight is in the normal "up" (heat on) position (Fig. 3).

10. Tack weld the valve to the shaft. Move the assembly back and forth to check for a binding condition.

11. If there is no binding, weld the valve to the shaft in the original manner. The shaft and valve are stainless steel to minimize corrosion and/or damage by excessive heat.

12. Install the thermostatic spring in the shaft slot. Secure the spring by crimping the shaft at the slot. Wind the spring ¾ turn and hook the open end of the spring over the stop pin. The thermostatic spring should hold the valve in the closed (heat on) position (i.e. in the proper position to direct the flow of gases into the heat riser).

13. Install the stop spring.

14. Lubricate the shaft bushings while operating the valve manually to replace the original lubricant lost by the welding operation. Install the manifold assemblies following the procedure under "Manifold Installation."

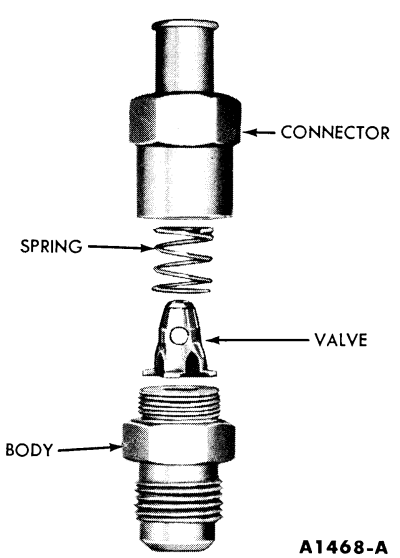

FIG. 17—Regulator Valve Assembly

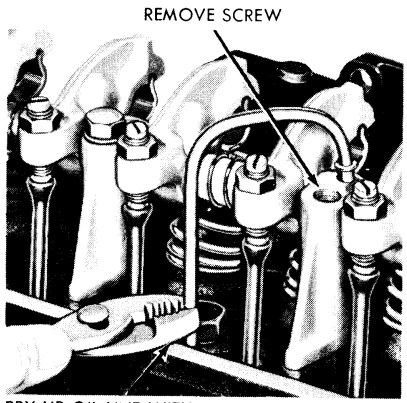

FIG. 18—Oil Inlet Line Removal

POSITIVE CRANKCASE VENTILATION SYSTEM

REMOVAL

1. Remove the crankcase ventilation exhaust tube by disconnecting the bracket from the intake manifold, the exhaust tube from the crankcase ventilation outlet adapter and from the regulator valve assembly (Fig. 16).

2. Remove the regulator valve assembly and the rubber connection.

3. Remove the crankcase outlet adapter.

INSTALLATION

1. Install the crankcase outlet adapter.

2. Position the rubber connection and clamps on the fitting in the intake manifold, then install the regulator valve. Position the clamps.

3. Install the rubber connection on the crankcase outlet adapter. Position and install the exhaust tube to the regulator valve and crankcase outlet adapter.

4. Install the bracket retaining bolts at the intake manifold.

REGULATOR VALVE DISASSEMBLY

Place the hex of the regulator valve body in a vise. Remove the connector, valve, and spring (Fig. 17).

CLEANING

Clean the valve parts, exhaust tube, and outlet adapter in clean carburetor solvent and dry them with compressed air. Clean the rubber hose connections with a low volatility petroleum base solvent and dry with compressed air.

REGULATOR VALVE ASSEMBLY

Position the spring and valve inside the regulator valve body. Install the regulator valve connector.

VALVE ROCKER ARM SHAFT ASSEMBLY

REMOVAL

1. Remove the air cleaner. Remove the valve rocker arm cover and discard the gasket.

2. Remove the cap screw and bracket from the No. 4 valve rocker arm shaft support. Pull the oil inlet line out of the support, then pull the line out of the block with pliers (Fig. 18). Discard the O-ring seal.

3. Remove the cap screw from the No. 1 valve rocker arm shaft support. Remove the oil outlet line and bracket.

4. Loosen all the valve rocker arm adjusting screws to remove the valve spring load from the rocker arms. Loosen the cap screws 2 turns at a time in sequence. Remove the valve rocker arm shaft assembly.

INSTALLATION

1. Apply Lubriplate to both ends of the push rods.

2. Position the valve rocker arm shaft assembly on the head.

3. Install the oil outlet line, bracket, and retaining screw on the No. 1 support. Make sure the oil line enters the shaft locating hole.

4. Install a new O-ring seal on the lower end of the oil inlet line. Position the line in the No. 4 support. Make sure the O-ring seal is in the oil supply counterbore. Install the bracket and support bolt.

5. Torque all the valve rocker arm shaft retaining bolts 2 turns at a time in sequence to specifications. Adjust the valve clearance.

6. Clean the valve rocker arm cover. Coat one side of a new valve rocker arm cover gasket with oil resistant sealer. Lay the cemented side of the gasket in place in the cover. Install the cover, making sure that the gasket seats evenly around the

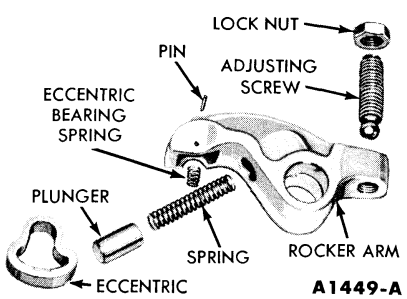

FIG. 19—Valve Rocker Arm Assembly

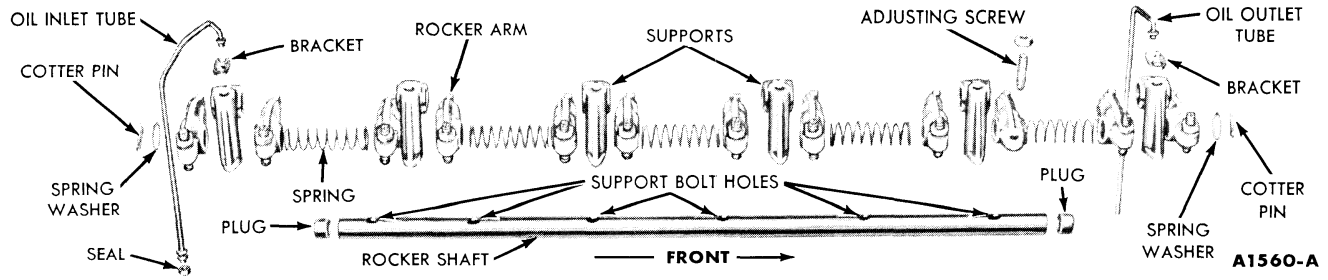

FIG. 20—Valve Rocker Arm Shaft Assembly

head. The cover is tightened in two steps. Torque the retaining bolts to specifications. Two minutes after the initial tightening, torque the bolts to the same specifications. Install the air cleaner.

DISASSEMBLY

1. Remove the cotter pins from each end of the valve rocker arm shaft. Remove the flat washers and spring washers.

2. Slide the rocker arms, springs, and supports off the shaft. Be sure to identify the parts.

3. If it is necessary to disassemble a valve rocker arm, push the eccentric retaining pin outward using needle nose pliers. Remove the eccentric, plunger, plunger spring and eccentric bearing spring. Identify all parts so that they may be installed in the rocker from which they were removed.

4. If it is necessary to remove the plugs from each end of the shaft, drill or pierce the plug on one end. Use a steel rod to knock out the plug on the opposite end. Working from the open end, knock out the remaining plug.

ASSEMBLY

1. Lubricate all moving parts with engine oil. Apply Lubriplate to the pad and to the eccentric foot of the valve rocker arms.

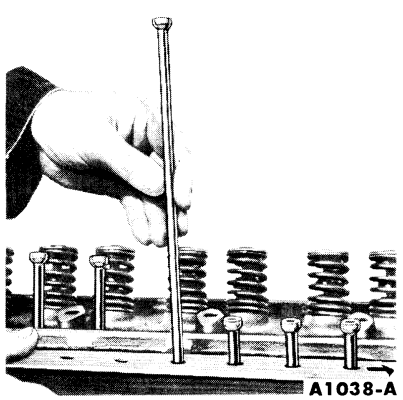

FIG. 21—Valve Push Rod Removal

2. If the plugs were removed from the ends of the shaft, use a blunt tool or large diameter pin punch and install a plug, cup side out, in each end of the shaft.

3. If a valve rocker arm was disassembled, install the plunger spring, plunger, eccentric bearing spring, and eccentric in the rocker arm from which they were removed (Fig. 19). **Be sure the eccentric is installed with the recessed dot (side with the smallest radius) toward the spring and plunger.** Push the eccentric retaining pin inward to its original position.

4. Install a spring washer, a flat washer, and a cotter pin on one end of the shaft.

5. Install the rocker arms, supports, and springs in the order shown in Fig. 20. **Be sure the oil holes in the shaft are facing downward.** Complete the assembly by installing the remaining spring washer, flat washer, and the cotter pin.

CYLINDER HEAD

Cylinder head repair operations and checks, such as valve and valve seat refacing, cylinder head flatness checks, etc., are covered in Part 1-1.

REMOVAL

1. Drain the cooling system. Remove the air cleaner.

2. Disconnect the radiator upper hose at the radiator and the heater hose at the coolant outlet housing.

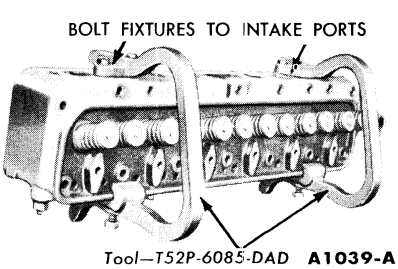

FIG. 22—Cylinder Head Holding Fixtures

3. Disconnect the water temperature sending unit wire at the sending unit, and the battery ground cable at the cylinder head.

4. Disconnect the carburetor fuel inlet line and the distributor vacuum line at the distributor.

5. Disconnect the high tension lead at the coil. Remove the coil from the head and move it to one side. Remove the distributor cap and the spark plug wires as an assembly. Remove the spark plugs.

6. Disconnect the fuel inlet line and the distributor vacuum line at the carburetor. Remove the lines as an assembly.

On an engine with positive crankcase ventilation, disconnect the exhaust tube at the regulator valve and crankcase outlet. Remove the exhaust tube.

7. Disconnect the choke control cable at the carburetor.

8. Disconnect the accelerator retracting spring. Disconnect the accelerator rod assembly at the accelerator assembly.

9. Remove the valve rocker arm shaft assembly as outlined in this section.

10. Remove the valve push rods in sequence and identify them so that they can be installed in their original position (Fig. 21).

11. Remove the manifold to cylinder head bolts (two manifold bolts retain the radiator supply tank mounting bracket and one bolt retains the oil level dipstick tube bracket). Pull the manifold assembly away

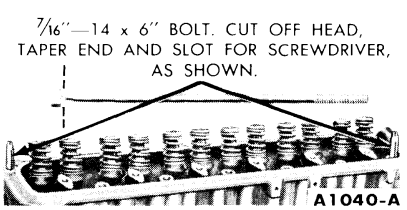

FIG. 23—Cylinder Head Guide Studs

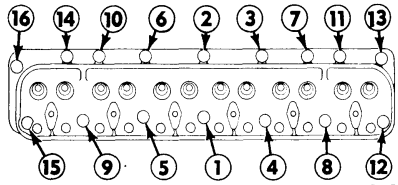

FIG. 24—Cylinder Head Bolt Tightening Sequence

from the cylinder head. Brace the assembly so that the muffler inlet pipe will not be damaged.

12. Disconnect the radiator supply tank support at the water pump. Loosen the supply tank hose clamp at the coolant outlet housing and remove the supply tank.

13. Install the cylinder head holding fixtures for convenience in lifting the head and to protect the gasket surfaces (Fig. 22).

14. Remove all cylinder head bolts. Install the cylinder head guide studs (Fig. 23). Lift the cylinder head assembly off the engine. **Do not pry between the head and block as the gasket surfaces may become damaged.**

INSTALLATION

1. Clean the head and block gasket surfaces .

2. If the cylinder head was removed for a cylinder head gasket replacement, check the flatness of the head and block gasket surfaces (Part 1-1).

3. Position the gasket over the guide studs on the cylinder block.

4. Lift the cylinder head over the guides and slide it down carefully.

5. Coat the threads of the bolts for the left side of the cylinder head with water resistant sealer.

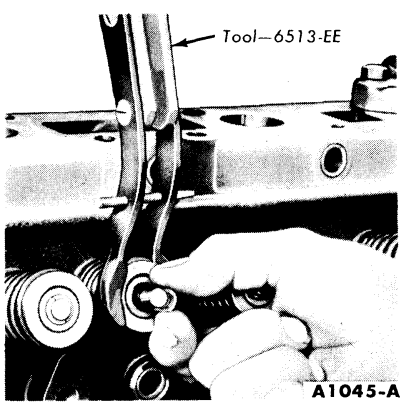

FIG. 25—Compressing Valve Spring

6. Install, but do not tighten, two bolts at opposite ends of the head to hold the head and gasket in position.

7. Remove the guides. Remove the cylinder head holding fixtures. Install the remaining bolts.

8. The cylinder head bolts are tightened in three progressive steps. Follow the sequence shown in Fig. 24. Torque the bolts to 95 ft-lbs, then to 105 ft-lbs. Finally, torque the bolts to 115 ft-lbs.

9. Apply Lubriplate to both ends of the push rods. Install the push rods in their original bores, positioning the lower end of the rods in the tappet sockets.

10. Install the valve rocker arm shaft assembly by following steps 1 thru 5 under "Valve Rocker Arm Shaft Installation."

11. Position the radiator supply tank and connect the hose at the coolant outlet housing. Position the generator adjusting arm and radiator supply tank support and install the retaining bolt.

12. Clean the intake manifold gasket surfaces. Install new intake manifold gaskets using new sleeves, if necessary, in the ports of the cylinder head. Place the manifold assembly in position against the head. **Make sure none of the gaskets have become dislodged.**

13. Install the manifold assembly retaining lock washers and bolts (two manifold bolts retain the radiator supply tank mounting bracket and one bolt retains the oil level dipstick tube bracket). Torque the bolts to specifications.

14. Connect and adjust the choke control cable.

15. Position the fuel inlet line and the vacuum line on the engine. Connect the distributor vacuum line and the carburetor fuel inlet line at the carburetor.

On an engine with positive crankcase ventilation, position and install the exhaust tube.

16. Connect the accelerator rod assembly and the accelerator retracting spring.

17. Install the ignition coil, spark plugs, and the distributor cap and spark plug wire assembly.

18. Connect the spark plug wires and the coil high tension lead.

19. Connect the carburetor fuel inlet line at the fuel pump, and the distributor vacuum line at the distributor.

20. Connect the battery ground cable. Connect the water temperature sending unit wire.

21. Connect the radiator upper hose at the radiator. Connect the heater hose at the water outlet housing, but do not tighten the clamp.

22. Fill and bleed the cooling system. Adjust the valves (Part 1-1). Install the valve rocker arm cover by following step 6 under "Valve Rocker Arm Shaft Assembly Installation."

23. Operate the engine until engine temperatures have stabilized.

24. Adjust the engine idle speed and idle fuel mixture. Install the air cleaner.

On a car with an automatic transmission, adjust the transmission control linkage.

DISASSEMBLY

1. Remove the coolant outlet housing and thermostat. Discard the gasket.

2. Remove the temperature sending unit from the head.

3. Remove deposits from the combustion chambers and valve heads with a scraper and a wire brush before removing the valves. **Be careful not to scratch the cylinder head gasket surface.**

4. Compress the valve springs (Fig. 25), then remove the valve retainer locks and release the spring.

5. Remove the sleeve, spring retainer, spring, stem seal, and valve. Discard the valve stem seals. Identify all valve parts.

ASSEMBLY

1. Lubricate the valve guides and valve stems with engine oil. Apply Lubriplate to the tip of the valve stems.

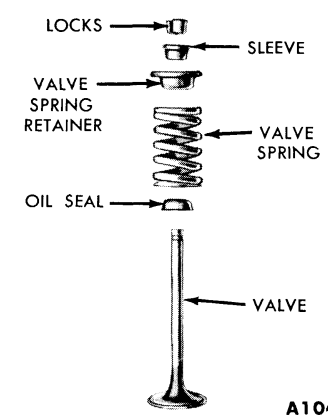

FIG. 26—Valve Assembly

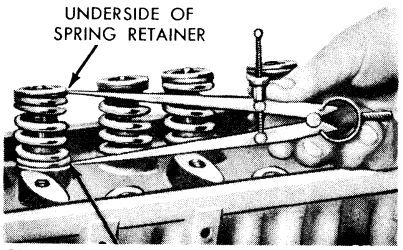

FIG. 27—Valve Spring Assembled Height

2. Install each valve (Fig. 26) in the valve guide from which it was removed or to which it was fitted. Install a new stem seal on the valve.

3. Install the valve spring assembly over the valve. Install the spring retainer and sleeve.

4. Compress the spring and install the retainer locks (Fig. 25).

5. Measure the assembled height of the valve spring from the surface of the cylinder head spring pad to the underside of the spring retainer with dividers (Fig. 27).

Check the dividers against a scale. If the assembled height is greater than the specified limit, install the necessary 0.030-inch thick spacer(s) between the cylinder head spring pad and the valve spring to bring the assembled height to the recommended dimension. **Do not install spacers unless necessary. Use of spacers in excess of recommendations will result in overstressing the valve springs and overloading the camshaft lobes which could lead to spring breakage and worn camshaft lobes.**

6. Install the temperature sending unit.

7. Using a new gasket coated with water resistant sealer, install the thermostat and coolant outlet elbow. Torque the retaining bolts to specifications.

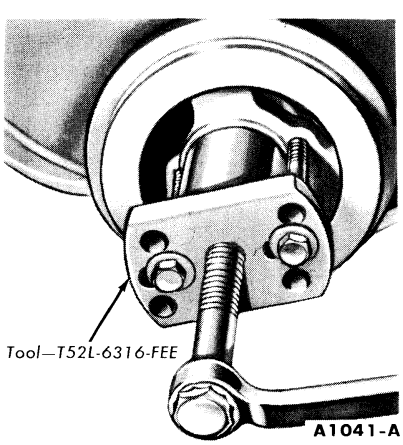

FIG. 28—Damper Removal

VALVE STEM SEAL REPLACEMENT

1. Remove the air cleaner and the valve rocker arm cover. Remove the applicable spark plug.

2. Crank the engine until the applicable piston is on TDC after the compression stroke. Be sure that both valves are closed.

3. Remove the push rod.

4. Install an air line with an adapter in the spark plug hole.

5. Push the rocker arm to one side and secure it in this position (Part 1-4, Fig. 31). To move the rocker arm on either end of the shaft, it will be necessary to remove the retaining pin and washers and slide the rocker arm off the shaft.

6. Turn on the air supply. Using the valve spring compression tool shown in Part 1-4, Fig. 31, compress the valve and remove the valve spring retainer locks, the sleeve, spring retainer, and the valve spring.

7. Remove the valve stem seal (Part 1-4, Fig. 32).

8. Install a new valve stem seal. Place the spring in position over the valve. Install the spring retainer and sleeve. Compress the valve spring and install the valve spring retainer locks.

9. Apply Lubriplate to both ends of the push rod. Install the push rod making sure the lower end of the rod is positioned in the tappet push rod cup.

10. Remove the wire securing the valve rocker arm and slide the rocker arm into position. If an end valve rocker arm was removed, slide it into position on the shaft and install the washers and retaining pin. Turn off the air and remove the air line and adapter. Install the spark plug and spark plug wire.

11. Adjust the valve lash.

12. Install the valve rocker arm cover and connect the spark plug wires. Install the air cleaner.

CYLINDER FRONT COVER AND TIMING CHAIN

REMOVAL

1. Drain the cooling system and crankcase.

On a car with an automatic transmission, disconnect the transmission oil cooler lines at the radiator.

2. Disconnect the radiator upper hose at the radiator supply tank and the radiator lower hose at the water pump. Remove the radiator.

3. Remove the fan, drive belt, and pulley.

On a car with power steering, remove the power steering pump drive belt. Remove the power steering pump pulley from the crankshaft damper.

4. Remove the cap screw and washer from the end of the crankshaft, then remove the damper (Fig. 28).

5. Remove the oil level dipstick. Remove the oil pan and related parts by following the procedure under "Oil Pan Removal." Remove the oil pump screen and inlet tube assembly.

6. Disconnect the heater hose at the water pump. Disconnect the generator adjusting arm and radiator supply tank support bracket at the water pump. Remove the water pump.

7. Remove the cylinder front cover and discard the gasket.

8. Remove the crankshaft front oil slinger. Rotate the crankshaft in a clockwise direction (as viewed from the front) to take up the slack on the left side of the chain.

9. Establish a reference point on the block and measure from this point to the chain (Fig. 29).

10. Rotate the crankshaft in the opposite direction to take up the slack on the right side of the chain. Force the left side of the chain

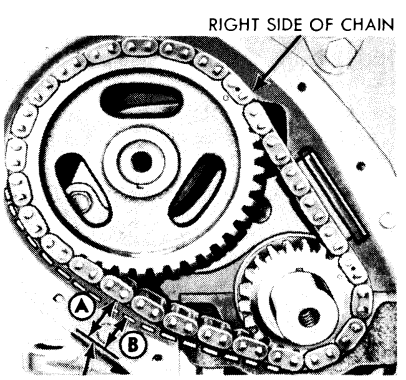
RIGHT SIDE OF CHAIN
A
B
REFERENCE POINT
TAKE UP SLACK ON LEFT SIDE. ESTABLISH A REFERENCE POINT AND MEASURE DISTANCE A. TAKE UP SLACK ON RIGHT SIDE AND FORCE LEFT SIDE OUT WITH THE FINGERS AND MEASURE DISTANCE B. DEFLECTION IS A MINUS B.
A1556-A

FIG. 29—Timing Chain Deflection

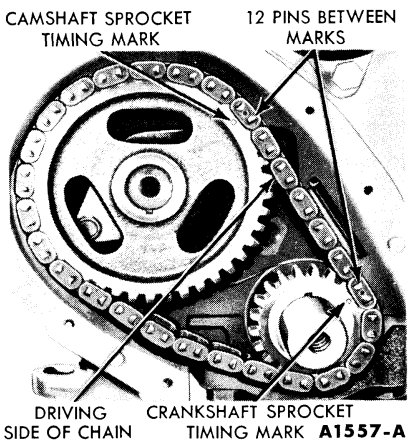

FIG. 30—Aligning Timing Marks

out with the fingers. Measure the distance between the reference point and the chain. The deflection is the difference between the two measurements.

11. If the deflection exceeds ½ inch, replace the timing chain and/or sprockets.

12. Crank the engine until the timing marks on the sprockets and chain are positioned as shown in Fig. 30.

13. Remove the camshaft sprocket retaining bolt and washer. Slide both sprockets and timing chain forward. Remove them as an assembly.

FRONT OIL SEAL REPLACEMENT

It is good practice to replace the oil seal each time the cylinder front cover is removed.

1. Drive out the old seal with a pin punch, then clean out the recess in the cover.

2. Coat a new seal with grease, then install the seal (Fig. 31). Drive the seal in until it is fully seated in the recess. After installation, check to be sure the spring is properly positioned in the seal.

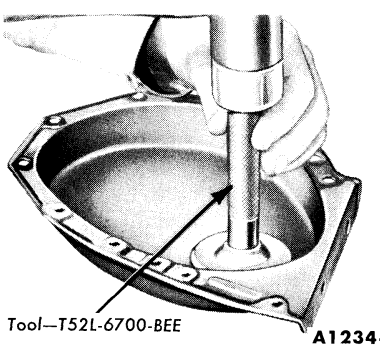

FIG. 31—Front Oil Seal Installation

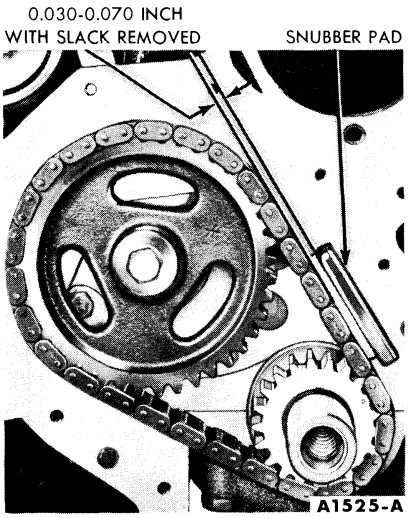

FIG. 32—Pad to Chain Clearance

INSTALLATION

1. Place the keys in position in the slots on the camshaft and crankshaft.

2. Position the sprockets and timing chain on the camshaft and crankshaft. Leave sufficient clearance between the sprockets and the front face of the cylinder block to insert an open-end wrench. Remove the slack from the drive side of the chain and measure the clearance between the pad and chain (Fig. 32). If the clearance is not to specifications, loosen the damper retaining screws. Reposition the damper assembly until the proper clearance is obtained. Torque the damper screws to specifications.

3. Be sure the timing marks on the sprockets and chain are positioned as shown in Fig. 30. Install the camshaft sprocket cap screw and washer. Install the crankshaft front oil slinger.

4. Clean the cylinder front cover and the gasket surface of the cylinder block. Coat the gasket surface of the block and cover with sealer. Position a new gasket on the block.

5. Insert the small diameter end of tool T52L-6059-AAE in the bore of the cover. Position the cover and pilot assembly over the end of the crankshaft and against the block. Install the cylinder front cover bolts. Torque the bolts to specifications.

6. Lubricate the crankshaft with a white lead and oil mixture. Lubricate the front oil seal rubbing surface with grease.

7. Align the damper keyway with the key on the crankshaft. Install the damper on the crankshaft (Fig. 33).

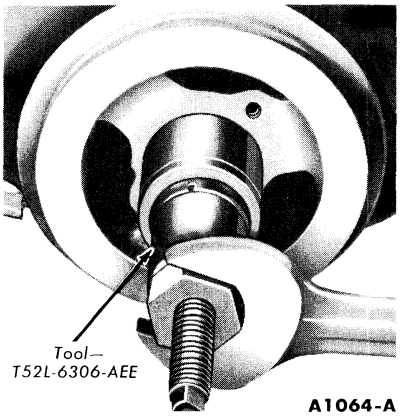

FIG. 33—Damper Installation

8. Install the lock washer and cap screw. Torque the cap screw to specifications.

9. Coat the water pump gasket and retaining bolts with water resistant sealer. Install the water pump. Connect the heater hose. Connect the generator adjusting arm and the radiator supply tank support bracket at the water pump.

10. Install the pulley, drive belt, and fan. Adjust the drive belt.

On a car with power steering, install the power steering pump pulley on the crankshaft damper. Install and adjust the power steering pump drive belt.

11. Clean and install the oil pump screen and inlet tube assembly. Install the oil pan and related parts following the procedure under "Oil Pan Installation." Install the oil level dipstick.

12. Install the radiator. Connect the radiator lower hose at the water pump and the radiator upper hose at the radiator supply tank.

On a car with an automatic transmission, connect the transmission oil cooler lines.

13. Fill and bleed the cooling system. Fill the crankcase.

14. Start the engine and adjust the ignition timing. Operate the engine at fast idle and check all hose connections and gaskets for leaks.

CAMSHAFT

The camshaft and related parts are shown in Fig. 34.

REMOVAL

1. Remove the crankshaft damper, cylinder front cover, and oil pan following the procedures in this section.